

**CLINICAL CHARACTERISTIC OF COVID-19 IN
ELDERLY AND MIDDLE-AGE ADULT IN DR
MOHAMMAD SOEWANDHI GENERAL HOSPITAL**

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ABSTRACT

Introduction: The different characteristics of the elderly and young people may provide different characteristics of COVID-19. This research aim is to provide information on the characteristics of COVID-19 patients, especially elderly patients. **Aim:** To analyzed comparisson of clinical characteristics of COVID-19 in elderly and young age patients. **Method:** This study is a retrospective observational study with a cross-sectional approach in COVID-19 patients hospitalized at Soewandi General Hospital from May 1st 2020, until November 31th 2020. This study compared the characteristics of COVID-19 patients at elderly and young ages. **Result:** There were 368 COVID-19 patients with 95 elderly patients (25.81%) and 273 young patients (74.19%). The most frequent symptoms experienced by elderly patients in sequence are cough, gastrointestinal disturbances, fever, and fatigue. It was found that the proportion of COVID-19 patients with comorbid diabetes mellitus (DM) and hypertension (HT) was higher in elderly patients than in younger patients ($p < 0.05$). There were statistically significant differences in the values of hemoglobin (Hb), lymphocytes, hematocrit, mean platelet volume (MPV), neutrophil-lymphocyte ratio (NLR), Serum Glutamic Pyruvic Transaminase (SGPT), blood urea nitrogen (BUN), serum creatinine (Sc), and D-Dimer between the elderly and young age groups ($p < 0.05$). **Conclusion:** COVID-19 has different clinical and laboratory characteristics between the elderly and young population. In the elderly infected with the COVID-19 population, we need more comprehensive clinical and laboratory evaluation to prevent COVID-19 morbidity and mortality.

Keyword: COVID-19, Elderly Patients, Hematologic Parameter.

ABSTRAK

Latar belakang: Perbedaan karakteristik pada lanjut usia (lansia) dan usia muda mungkin dapat memberikan gambaran karakteristik COVID-19 yang berbeda. Melalui penelitian ini diharapkan dapat memberikan informasi karakteristik pasien COVID-19, terutama pada pasien lansia. **Tujuan:** Menganalisis perbedaan karakteristik klinis dari COVID-19 pada pasien lansia dan usia muda. **Metode:** Penelitian ini merupakan studi observasional retrospektif dengan pendekatan belah lintang pada pasien COVID-19 yang dirawat inap di Rumah Sakit Umum Soewandi pada periode 1 Mei 2020 hingga 31 November 2020. Penelitian ini membandingkan karakteristik pasien COVID-19 pada lansia dan usia muda. **Hasil:** Total pasien COVID-19 diperoleh 368 orang, yang terdiri dari 95 pasien lansia (25,81%) dan 273 pasien usia muda (74,19%). Gejala paling sering yang dialami pasien lansia adalah batuk, gangguan gastrointestinal, demam, dan lemas. Proporsi pasien COVID-19 dengan komorbid diabetes melitus (DM) dan hipertensi (HT) lebih banyak pada pasien lansia dibandingkan pasien usia muda ($p < 0,05$). Terdapat perbedaan bermakna secara statistik pada nilai hemoglobin (Hb), limfosit, hematokrit, *mean platelet volume* (MPV), rasio neutrofil limfosit (NLR), *Serum Glutamic Pyruvic Transaminase* (SGPT), *blood urea nitrogen* (BUN), *serum creatinine* (Sc), dan D-Dimer antara kelompok lansia dan usia muda ($p < 0,05$). **Kesimpulan:** COVID-19 memiliki karakteristik klinis dan laboratorium yang berbeda antara populasi lansia dan usia muda. Populasi lansia yang terinfeksi COVID-19 memerlukan evaluasi klinis dan laboratorium yang lebih komprehensif untuk mencegah morbiditas dan mortalitas karena COVID-19.

Kata Kunci: COVID-19, Pasien Lansia, Parameter Hematologis.

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INTRODUCTION

Coronavirus Disease 2019 (COVID-19) by the World Health Organization (WHO) has caused disasters and burdens in all countries, including Indonesia¹. Data in Indonesia until February 10th 2021, most people with COVID-19 were aged 31-45 years (29.86%), patients aged 19-30 years (24.95%), patients aged 46-59 years (22.64%), sufferers aged ≥ 60 years (10.66%) and patients aged ≤ 18 years (11.89%). The elderly group had the highest mortality rate (47.8%)². Those data has shown that the age factor plays a role in the severity of COVID-19 and caused mortality.

Clinical findings patients with COVID-19 are varied widely, from asymptomatic to acute respiratory distress syndrome³. Elderly patients have varied symptoms; several studies have shown that cough, fever, shortness of breath, and fatigue are the most common symptoms^{4,5,6}. The majority of elderly patients were aged 60-69 years, male, and had no history of contact with COVID-19 patients before⁶. Elderly patients also had a higher *Pneumonia Severity Index* score⁵.

Most of the elderly had underlying diseases, and the most common are cardiac disease, hypertension, diabetes mellitus, and cerebrovascular disease^{4,5}. In Indonesia, the majority of patients with covid-19 had comorbidities, such as hypertension (50.7%), diabetes mellitus (34.8%), and cardiac disease (17.7%)². This data had shown that the elderly with comorbidities have significant correlations with the risk of infection in COVID-19. However, some studies state that there are no correlations between comorbid with the severity of covid-19⁶.

Laboratory findings are needed for patients with covid-19, such as coagulant factor and fibrinolysis factor (LED, CRP, ferritin, and pro-calcitonin)⁷. laboratory findings in elderly patients were different compared to the young population. An elderly patient had higher CRP and D-dimer⁴. Lymphocytes slightly lower in elderly patients⁵. Blood urea nitrogen (BUN) and serum creatinine were also higher in elderly patients. Those renal function results may be associated with decreased kidney function

because of the aging process⁴. Elderly patients may be at risk of suffering more severe symptoms of Covid-19 because of multiple comorbid factors and the body's immune system that is no longer optimal due to age. This research aims were to compare the different characteristics of COVID-19 patients between the elderly population (age \geq 60 years) and the young population (aged 18-60 years).

METHODS

This study is a retrospective observational study with a cross-sectional approach that examined COVID-19 patients hospitalized at Soewandhi General Hospital from May 1st 2020 until November 31th 2020. Diagnosis of COVID-19 was based on positive PCR swab results. This study divides the research sample into two research groups. The first group is elderly patients (age $> =$ 60 years), and the second group is young patients (aged 18-59 years). Identity data, clinical symptoms, comorbid and laboratory data were obtained from medical records.

The COVID-19 severity is based on the guidelines for managing

COVID-19. The criteria of mild degrees are patients without evidence of pneumonia or hypoxia (saturation $\geq 95\%$). The moderate degree is a patient with clinical signs of pneumonia (fever, cough, shortness of breath, rapid breathing) but no signs of severe pneumonia, including $SpO_2 \geq 93\%$. The severe degree is a patient with clinical signs of pneumonia (fever, cough, shortness of breath, rapid breathing) plus one of the following symptoms: respiratory rate $> 30x$ / minute, severe respiratory distress, or $SpO_2 < 93\%$.⁸

Parametric variables were described as medians and quartile ranges (Q1-Q3). Non-parametric variables were described by numbers (percentages). The independent t-test was used if the parametric data were normally distributed, and the Mann-Whitney U test was used if the parametric data were not normally distributed. The Chi-square test was used to analyze non-parametric variables of 2x2 tables. The statistical test used SPSS version 23.0, and the p-value < 0.05 had a statistically significant value.

RESULT

In this study, 368 patients with confirmed COVID-19 were found. There were 95 elderly patients (25.81%) and 273 young patients (74.19%). There was no statistically significant gender difference ($p = 0.868$) between the elderly and middle-aged adult groups, with more female patients than male patients. There were differences in systole, diastole, pulse, and O₂ saturation which were statistically significant (p

$= 0.015$; $p = 0.006$; $p = 0.028$; $p = 0.041$) between the elderly and young groups. There was higher systole in the elderly patient's group compared with the middle-aged adult group. Diastole, heart rate, and O₂ saturation were lower in the elderly group than in middle-age adults. There was no statistically significant difference in respiratory rate, temperature, and length of stay ($p = 0.278$; $p = 0.691$; $p = p = 0.38$) between the elderly and young groups. (**Table 1**)

Table 1. Clinical Characteristic Comparison Between COVID-19 Elderly Patients and Middle-Age Adult Patients

Clinical Characteristic	Elderly (n = 95)		Middle-age Adult (n = 273)		P-Value
	Median	Q1-Q3	Median	Q1-Q3	
Gender	Male	46 (47.9%)	134 (48.9%)		0.868
	Female	50 (52.1%)	140 (51.1%)		
Age (years)	65	62 – 71	48	38.5 – 54	0.000**
Systole (Mm Hg)	140	124 – 159	130	118 – 147	0.015*
Diastole (Mm Hg)	78	68 – 9	81	73 – 90	0.006*
Heart rate (beats/minute)	92	81 – 105	98	85.5 – 110	0.028*
Respiration rate (/minute)	20	20 – 24	20	20 – 24	0.278
Temperature (°C)	36.5	36.2 – 36.9	36.5	36.1 – 36.85	0.691
O ₂ Saturation (%)	96	92 - 98	98	94 – 98	0.041**
Length of stays (days)	11	7-15	10	6 - 15	0.380

*T-independent test statistical significant ($p < 0.05$)

**Mann-Whitney U test statistical significant ($p < 0.05$)

In this study, there were differences in the number of COVID-19 patients with comorbid diabetes mellitus (DM) and patients with comorbid hypertension (HT), which were statistically significant between the elderly and young groups ($p = 0.003$; $p = 0.004$). It was found that COVID-19 with comorbid DM in the elderly group ($n = 47$; 49.5%) was higher in the middle-aged adult group. It was found that there were more COVID-19 patients with comorbid HT ($n = 45$; 47.4%) in the elderly group than in the middle-aged adults group. It was found that clinical symptoms of fatigue were more common in the elderly group ($n = 36$; 37.9%) compared to the middle-aged

adult group with a significant statistical test ($p = 0.008$). The clinical symptom of cough was the most common clinical symptom in both the elderly group (56.8%) and middle-aged adults (65.9%). There were no statistically significant differences in the clinical symptoms of fever, cough, headache, fatigue, and gastrointestinal disorders between the elderly and middle-aged adult groups ($p > 0.05$). There was no statistically significant difference in the severity of COVID-19 ($p = 5.25$), but in the elderly group, the number of patients experiencing severe degrees was higher than the middle-aged adult group ($n = 23$; 24.2%).(Table 2)

Table 2. Comorbidity and Clinical Characteristic of COVID-19 Patients Between Elderly and Middle-Age Adult.

Clinical Characteristic and Comorbidity		Age Category		p-value
		Elderly	Middle-aged adults (Age 18-60 years)	
Diabetes mellitus (DM)	No	48 (50.5%)	184 (67.4%)	0.003*
	Yes	47 (49.5%)	89 (32.6%)	
Hypertension (HT)	No	50 (52.6%)	188 (68.9%)	0.004*
	Yes	45 (47.4%)	85 (31.1%)	
Fever	No	58 (61.1%)	166 (60.8%)	0.966
	Yes	37 (38.9%)	107 (39.2%)	
Cough	No	41 (43.2%)	93 (34.1%)	0.113
	Yes	54 (56.8%)	180 (65.9%)	
Fatigue	No	59 (62.1%)	208 (76.2%)	0.008*
	Yes	36 (37.9%)	65 (23.8%)	
Headache	No	84 (88.4%)	246 (90.1%)	0.641
	Yes	11 (11.6%)	27 (9.9%)	
Dyspnea	No	45 (47.4%)	126 (46.2%)	0.838
	Yes	50 (52.6%)	147 (53.8%)	
Gastrointestinal disturbance	No	56 (58.9%)	178 (65.2%)	0.275
	Yes	39 (41.1%)	95 (34.8%)	
Severity	Mild	58 (61.1%)	172 (63%)	0.525
	Moderate	14 (14.7%)	51 (18.7%)	
	Severe	23 (24.2%)	50 (18.3%)	

*Chi-Square test statistical significant ($p < 0.05$)

In this study, there were statistically significant differences in the values of hemoglobin (Hb), lymphocytes, hematocrit, mean platelet volume (MPV), neutrophil-lymphocyte ratio (NLR), SGPT, blood urea nitrogen (BUN), serum creatinine (Sc), and D-Dimer between elderly and middle-aged adult groups ($p < 0.05$). It was found that the Hb, lymphocyte, hematocrit, MPV, and SGPT values were lower in the

elderly group than in the middle-aged adults group. It was found that the NLR, BUN, Sc, and D-dimer values were higher in the elderly group than in the middle-aged adult group. There were no statistically significant differences in the values of leucocytes, neutrophils, monocytes, platelets, absolute lymphocyte count (ALC), SGOT, sodium, and potassium ($p > 0.05$). (**Table 3**)

Table 3. Laboratory Comparison Results

Laboratory parameters	Elderly		Middle-age adult (Age 18-60 years)		P-Value
	Median	Q1 -Q3	Median	Q1 - Q3	
Hemoglobin (Hb)	13.1	11.675 - 14	13.6	12.2 – 14.975	0.007*
Leukocyte (10 ³ /μl)	9.15	6.812 – 12.922	7.9	5.85 – 11.042	0.023
Neutrophil (%)	73.5	65.575 – 84.25	70.55	63.5 – 79.25	0.055
Lymphocyte (%)	15.95	9.475 – 22.875	19.75	13.225 – 26.175	0.008*
Monocyte (%)	7.5	5.55 – 10.085	7.1	5.7 – 9.05	0.333
Hematocrit (%)	38.25	34.575 – 40.95	40.1	36.1 – 43.05	0.002*
Thrombocyte (10 ³ /μl)	298.5	213 - 410	287	218.5 - 357	0.464
Mean platelet volume (MPV) (fL)	9.5	9.1 – 10.125	9.8	9.225 – 10.6	0.018*
NLR (Neutrophil lymphocyte ratio)	4.421	2.8598 – 8.8294	3.5189	2.425 – 5.871	0.009*
ALC (<i>Absolute lymphocyte count</i>)	1316.64	967.12 – 1930.22	1482.21	1103.142 – 1991.805	0.180
Serum Glutamic Oxaloacetic Transaminase (SGOT)(U/L)	34	21.75 – 49.5	34.5	21 – 64.75	0.368
Serum Glutamic Pyruvic Transaminase (SGPT)(U/L)	33	24 – 50.5	45	29.25 – 72.75	0.006*
Blood urea nitrogen (BUN)(mg/dL)	17	12.75 – 22.5	11	9 - 17	0.000*
Serum creatinin (Sc)	1.2	1.4 – 1.7	0.9	0.8 – 1.2	0.000*
Sodium (mmol/L)	139	135 - 143	141	138 - 144	0.094
Potassium (mmol/L)	4.1	3.6	4.1	3.8	0.785
D-Dimer(μg/L)	640.5	390.8	444.5	252.9	0.003*

* Mann-Whitney U test test statistical significant (p < 0.05)

DISCUSSION

The difference in the total case of infectious disease often is linked with three factors: the difference in X chromosome-related immune function, sexual hormones influence, and the difference in gender-related behavior⁹. In this research, no significant (p = 0.868) gender difference was seen in young and

elderly groups, with more females than male patients.

In this research, there were more young patients than elderly patients. Findings in this research were in line with the findings from previous one, which there were more patients with middle-age adults infected with COVID-19¹⁰. This might be caused by a relatively larger

middle-aged adult population who tend to have more SARS-CoV-2 virus exposure because of their busy daily activity compared to the elderly.

Many factors contribute to morbidity and mortality in patients with COVID-19; there are age, diabetes mellitus (DM), and hypertension¹¹. In this study, the elderly with COVID-19 infection had DM comorbid higher prevalence than a middle-aged adult with COVID-19. The elderly population had diabetes mellitus prevalence higher than the middle-aged adult population. DM can increase viral affinity in the cell, which will make the virus get in quickly into our body. Diabetes mellitus also reduces T-cell function, contributing to a defense mechanism against the virus, increasing the risk of hyper inflammation state, and cytokine storm syndrome¹². Some studies described increasing Angiotensin-converting enzyme 2 (ACE2) expression in lung which had a role in the entry of the virus in DM patients¹³. These reasons might explain that patients with DM have a higher probability of COVID-19 infection than patients without DM comorbid.

The study from Zhang et al. describes the elderly population with DM and COVID-19 had a risk of severe symptoms and decreased O₂ saturation compared with the elderly population without DM. Elderly patients with DM have inferior laboratory markers (albumin, blood urea nitrogen, lactate dehydrogenase C-Reactive Protein, and D-dimer) than elderly patients without DM¹⁴. SHAP's Study analysis showed patients with high blood glucose-related with a bad prognosis on COVID-19 infection in elderly population¹⁵.

Hypertension is one of the most common comorbidities in the elderly population¹⁶. With increasing age, there is a change in body function, for example arterial stiffness, neurohormonal and autonomic dysregulation, decreased immune system and decreased kidney function.¹⁷ In Elderly using antihypertensive drug is much more common compared to middle-age population and at an older age there is reduced arterial compliance, this might explain lower diastolic blood pressure in elderly.¹⁸ These changes might contribute to hypertension and

explain why the geriatric population had hypertension comorbidities more than the middle-aged adult population.

Some studies found that hypertension is a comorbid factor in COVID-19 patients with severe symptoms¹⁹. The study from Italy concludes that a higher prevalence of COVID-19 infection was at risk in hypertension patients²⁰. In conclusion, these three problems are related to COVID-19 infection. Starting from elderly patients with hypertension, age factor, and hypertension are also related to COVID-19 severity.

Clinical symptoms in patients with Covid 19 vary between age groups. Diarrhea is most often seen in patients aged 1-19; fever often occurs in patients aged 20-49; meanwhile, cough is more often observed in patients aged 40-79.²¹ Other studies regarding COVID-19 in elderly patients found that fever and cough are the dominant symptoms, followed by fatigue and dyspnea. Other symptoms that are less often seen are diarrhea, anorexia, headache, myalgia, and vomiting.²² In this study, the clinical symptom fatigue is

often found in the elderly group ($n = 36$; 37.9%) than the middle-aged adult group with statistical significance difference ($p = 0.008$). There is a statistically significant difference in fever, cough, headache, dyspnea, and gastrointestinal symptoms between age groups ($p > 0,05$).

The elderly are associated with more severe symptoms of COVID-19 than the younger population. This phenomenon is associated with deterioration of immune function in the elderly (immunosenescent), continual production of inflammatory mediators and cytokines, functional decline of upper respiratory tract clearance, and comorbidities in the elderly.²³ In this study, the prevalence of COVID-19 patients with severe symptoms is higher in the elderly population (24.2%) than in the younger population (18.3%), although there is no significant association between old age and the severity of the symptoms. This study is similar to what Wei et al. found, that the older patients were more likely to present more severe symptoms, exhibit significant

systemic inflammation, pulmonary and extrapulmonary organ damage, and a higher mortality.²²

In complete blood count, we found significant differences in hemoglobin, leucocyte, and hematocrit in the elderly than in younger patients, while the thrombocyte count did not differ in elderly and younger patients. Although we found a significant difference, hemoglobin, leucocyte, and hematocrit counts between the two groups were still within normal limit. Low hemoglobin count in COVID-19 patients might be associated with systemic inflammation, which disrupts the erythropoiesis process. Excessive production of IL-6 affects iron metabolism, while other pro-inflammatory cytokines (*interferon- γ* , IL-1, IL-33, and TNF- α) inhibit progenitor and precursor cells and may reduce erythrocyte lifespan²⁴. Lower hemoglobin counts in the elderly compared to younger patients might be caused by malnutrition and decreased effective erythropoiesis function.²⁵ Similar observation has been reported by Wei et al., and Zhao et al., Wei et al., who found lower

hemoglobin in elderly patients, and Zhao et al. found that the older patients with COVID-19 had underlying chronic disorders are more likely to develop leucocytosis.^{25,26}

Patients with COVID-19 had a lower lymphocyte count and more severe lymphopenia occurred in elderly patients. This phenomenon might be related to immunosenescent which is an age-related process that affects both adaptive and innate immunity, therefore elderly are more susceptible to infectious disease. Immune organs, such as thymus and lymph node atrophy, gradually with age and profoundly affect the phenotype and function of various immune cells.²⁵ In this study, the elderly had significantly lower lymphocyte count (15.95%) than in younger patients (19.75%). Conversely, the neutrophil count is higher in the elderly than in younger patients, although this difference is statistically insignificant. The higher count of neutrophils in the elderly suggests an augmented inflammatory response, especially in the elderly with comorbidities.^{25,26} Our observation is similar to Wei et al., who found a decrease of lymphocytes

and increased neutrophil count.²⁵ The study from S.-P Dai et al. showed significant decreased number of CD8+ T lymphocytes and B lymphocytes in elderly patients that suggesting indicate low immune function in elderly compared with middle-age group.²⁷

Our study showed significant results between MPV value in elderly and younger patients with COVID-19. There was a similar result in Hu Yun et al. and Zong et al.'s The increase of MPV value may occur because of systemic inflammation and hypercoagulation. Because of that, production of thrombopoietin and megakaryocyte increased by medulla spinalis.^{28,29} In our study, MPV values were higher in younger patients than in elderly patients. This study results were also in line with Fabio Perotta et al. study that found MPV in younger patients was much higher than in elderly patients because of the immunosenescence process.³⁰ In another study, there were no significant differences in platelet and MPV value among elderly and younger patients.³¹ Different results were found by Pinti et al. that MPV value is much higher in elderly than

younger patients. The cause of higher MPV values in elderly patients is the upregulation of TLR4, which can result in uncontrolled systemic immune response and platelet activation³².

Our study showed a high NLR value in an elderly and younger patient with COVID-19. The result was in line with Liu et al. study³³. The cause of higher NLR is because an increase of total leucocyte count and destroyed lung cells trigger innate immune response mediated by macrophage and granulocyte.³³ In our study, there was a higher increase in NLR value in elderly than younger patients. Our results were also similar to Liu et al. study. In that study, patients over 50 years have higher NLR value and higher mortality.³³ The older the patient, the NLR value and severity of the patient will increase.³⁴

In our study, there was no significant correlation between ALC values between elderly and younger patients. Our result differs from Huang et al., that found ALC has a significant correlation in elderly than younger patients. ALC value was much higher in the younger patient

than the elderly. This may be because of the aging process in the immune system of the elderly that causes a decrease in the production of lymphocyte.³⁵

There were significant differences in liver function tests results, where the SGPT results were significant between the elderly group (median = 33) and the middle-aged adult group (median = 45). However, in contrast to SGOT value, the results were not significant between the two groups. In a study conducted in Wuhan comprising 339 elderly COVID-19 patients; There was no significant difference in SGPT results between elderly COVID-19 patients who died and elderly COVID-19 patients who survived.³⁶ The experts think that abnormal liver function tests are common in patients with COVID-19, but clinically significant liver function impairment may not be a prominent symptom of COVID-19.³⁷

Besides liver function tests, there were also significant results for kidney function tests. The difference in BUN and SCr values was significant between elderly and young patients ($p = 0.000$). Where in elderly

groups, the BUN and SCr values are higher than the young patients. Another study in Wuhan found significantly higher BUN and Scr values in COVID-19 elderly patients who died.³⁷ Recent studies have shown that SARS-CoV-2 can directly affect kidney cells, so this can result in high BUN levels can predict mortality in the elderly with COVID-19.^{38,39}

In our study, elderly patients had a higher D-dimer; they had D-dimer level 640.5 than middle-aged adults at 440,5 ($p < 0,05$). Some studies also had the same result as ours; Guo, et al. and Yuan X et al. state that d-dimer level increased in elderly patients^{4,40}. In Guo, et al. study, the elderly had a higher level of D-dimer, but no subjects were diagnosed with VTE (*Venous Thrombo Embolism*). This suggests that the elevated D-dimer is associated with COVID-19 infection⁴. Severe COVID-19 can cause cytokine storm and systemic inflammation, leading to hypercoagulation, which could elevate D-dimer value⁴¹. These events explained that elevated D-

dimer might evaluate prognosis and patient severity^{4,40}.

Based on the discussion above, this study found some different characteristics between elder patients and young patients infected with COVID-19 infection. Elderly patients infected with COVID-19 might need a more comprehensive examination and approach because of multiple comorbidities. Further study might need to evaluate other factors that differ from elder patients and young patients infected with COVID-19 infection.

LIMITATION

There was some limitations in this study. This study is not dynamic in following the patient's condition every day. The relatively small number of samples in the elderly category may influence the results of the study. Thus, further research is needed to overcome this limitation.

CONCLUSION

COVID-19 has different clinical and laboratory characteristics between the elderly and young population. Severe severity and various comorbidities are more often found in the elderly population than middle-aged adults, and this makes us

need to be more vigilant in dealing with elderly patients infected with COVID-19. Elderly patients also experience an increase in D-dimer more often than middle-aged adults, making it necessary to do D-dimer examination, especially in elderly patients. Through the COVID-19 vaccination program in the elderly population, it is hoped that it can reduce the morbidity and mortality rates of COVID-19 in various countries.

ETHICAL

The study protocol was approved by the Health Research Ethics Committee of Widya Mandala Catholic University Surabaya Faculty of Medicine with reference number 129/WM12/KEPK/DOSEN/T/2020 and Dr. Mohammad Soewandhi General Hospital with reference number 015/KE/KEPK/2020.

AUTHOR CONTRIBUTION

All the authors were participating actively in research and article writing and were partly responsible for the content of the writing, including in the preparation and writing of concepts, designs, analysis, or revision of the article.

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