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Clinical profile, treatment, and outcomes of patients with COVID-19 in a tertiary referral hospital in South Sumatera, Indonesia: A retrospective single-center study

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Abstract

Background: Although there are fewer COVID-19 cases in Indonesia, the pandemic is still ongoing. COVID-19 has a significant death rate in Indonesia, but lack of information on the effect of different clinical and demographic factors on COVID-19-related grimness and mortality in Indonesia.

Objective: This study examined the clinical profile, treatment, and outcomes of patients with COVID-19 at Lahat Regency Hospital in South Sumatera, Indonesia, to find relevant markers that might be utilized to predict the prognosis of these patients.

Methods: This was a retrospective single-center study of all medical record files of confirmed patients with COVID-19 admitted to Lahat Hospital from September 2020 to August 2021 (*n* = 285). Descriptive statistics, Chi-square, Mann-Whitney, Multiple Logistic Regression, and Cox's proportional hazards model were used for data analyses.

Results: This study included 65 non-hospitalized and 220 hospitalized patients. Hospitalized patients were divided into dead and alive groups. The median age was lower in the non-hospitalized group without gender discrimination, and most hospitalized patients had comorbidities. Vital signs and clinical features were significantly different in hospitalized patients compared to non-hospitalized. The survival patients in the hospitalized group showed lower white blood cell (WBC), neutrophil percentages, and neutrophil-lymphocyte ratio (NLR) but higher lymphocyte and eosinophil. Non-survival patients had elevated alanine aminotransferase (ALT), blood urea nitrogen (BUN), creatinine, blood glucose, and potassium. The use of Favipiravir and Remdesivir was significant between the alive and dead groups. The mean hospital stay for all patients was 9.49 ± 4.77 days, while the median duration of hospital time was 10.73 ± 4.33 days in the survival group and 5.39 ± 3.78 days in the non-survival group. Multiple logistic regression analysis determined respiration rate, WBC, and BUN as predictors of survival.

Conclusions: Age and comorbidities are significant elements impacting the seriousness of COVID-19. Abnormal signs in laboratory markers can be used as early warning and prognostic signs to prevent severity and death. Potential biomarkers at various degrees in patients with COVID-19 may also aid healthcare professionals in providing precision medicine and nursing.

Keywords

COVID-19; clinical profile; mortality; biomarkers; medical records; logistic models; Indonesia

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Background

The new severe acute respiratory syndrome coronavirus (SARS-CoV-2) has spread quickly around the world, causing an unprecedented pandemic. Patients tainted with SARS-CoV-2 showed a scope of clinical side effects, including raised internal heat level, hack, headache, anosmia, queasiness, spewing, anorexia, diarrhea, shortness of breath, and multiple organ dysfunctions (COVID-19 Response Acceleration Task Force, n.d.; Pogoy & Cutamora, 2021). Age, obesity, diabetes, hypertension, and comorbidities like heart, chronic lung, and liver illness affect COVID-19 cases' mortality rates (Pouw et al., 2021). Other factors such as male gender, smoking, lifestyle, and racial/ethnic differences also play a significant role in the severity of COVID-19 (Zhang et al., 2022).

Clinical and research center information distinguished risk factors that could foresee sickness seriousness. Early identification of risk factors for severe disease can help physicians take appropriate corrective action and control mortality. Past writing on research facilities affirmed COVID-19 cases and announced changes in understanding biochemical boundaries, including lymphocyte counts and neutrophil counts (Bairwa et al., 2021). Clinical parameters may not be as objective as laboratory parameters in assessing the patient condition. Unusual degrees of lab markers such as C-reactive protein (CRP), D-dimer, lactate dehydrogenase (LDH), interleukin (IL)-6, and fibrinogen have been reported to correlate with disease severity (Hu & Wang, 2021; Lozano et al., 2022; Samprathi & Jayashree, 2021).

Indonesia's first locally transmitted case occurred in early March 2020, and by August 2022, the COVID-19 cases reached 6.3 million with a fatality rate of 2.5% (COVID-19 Response Acceleration Task Force, n.d.). South Sumatra ranks 15th with 1.3% of COVID-19 cases, and Lahat Regency had more than 2900 confirmed cases with a 4.7% death rate (COVID-19 Response Acceleration Task Force, n.d.). Entering November 2022, the daily cases of COVID-19 in Indonesia experienced a drastic spike. As of 4 November 2022, the number of confirmed cases reached 5,303. While from late September to early October, daily cases typically range from 2,000 to 3,000 cases. The novel Omicron subvariant was likely to cause one of the increases in coronavirus infections (COVID-19 Response Acceleration Task Force, n.d.).

In the fight against COVID-19, finding clinical and analytical indicators of illness progression to severe and critical forms is urgently needed. These markers will support clinical management by focusing on patients at increased risk for severe disease and optimizing resource allocation in the current pandemic, especially in a rural area in Indonesia with limited human and technical resources.

A study about associations between demographic and clinical characteristics and outcomes was conducted in Indonesia. A report states that a quarter of elderly ICU patients died, which increases with comorbidities and COVID-19 status (Rehatta et al., 2022). Age, liver, and kidney function were emphatically connected with seriousness and mortality in Central Sulawesi (Faustine et al., 2021). A study at UKI hospital in Jakarta found that patients more than 60 with heftiness, low fringe oxygen immersion, high white platelet count, windedness, and respectably extreme COVID-19 on confirmation were at expanded hazard of death or reference to the ICU (Setianegari et al., 2022).

Our study evaluated patients infected by SARS-CoV-2 at Lahat Hospital, a tertiary referral hospital in South Sumatra, Indonesia. Research in this hospital is also limited. Thus, our study aimed to identify significant markers that may be used to predict the prognosis of patients with COVID-19 by evaluating their clinical profile, treatment, and outcomes to help clinicians (physicians, nurses, and pharmacists) in distinguishing extreme cases at first, working with proper strong administration, and improving the management of patients with COVID-19. Additionally, based on the severity of the patient's symptoms, potential biomarkers that are present at various degrees in patients with COVID-19 may aid medical professionals in providing precision medicine, including precision nursing.

Methods

Study Design

This was a retrospective single-center study to evaluate the clinical and treatment output of patients with COVID-19 through all medical record (MR) files at Lahat Hospital, South Sumatra, Indonesia.

Samples

All patients with COVID-19 positive verified with RT-PCR and had complete medical records were included in the study between September 2020 and August 2021, excluding all patients <18 years old. The flow chart of the patient selection process is described in **Figure 1**.

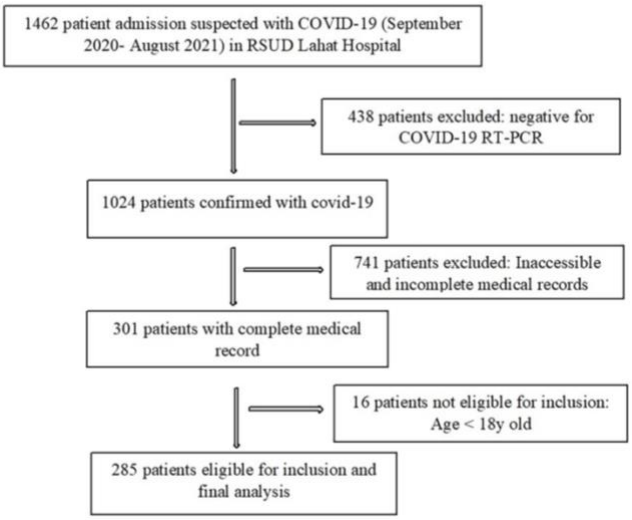

Figure 1 Flow chart of the patient selection process

Data Collection

Data collected from medical record (MR) files included vital signs on admission, comorbidities, laboratory test result, and treatment. In addition, the following laboratory data were also collected: WBC count, lymphocyte count, platelet count, blood chemistry, blood glucose, renal parameters, liver function tests, and blood electrolytes.

Data Analysis

All data analyses were performed using SPSS version 21 (IBM Corp., Armonk, NY, USA). First, we categorized patients into hospitalized and non-hospitalized patients. Then, since the non-hospitalized patient was a mild type, hospitalized patients were split into two groups based on survival status: alive and dead. The numerical variables were delivered as the mean ± standard deviation, and all categorical variables were presented as numbers and percentages. Hospitalized patients were compared with non-hospitalized patients. Categorical variables were analyzed using Chi-square, and the Mann-Whitney was to evaluate the outcome variables. Hospitalized group analyses were also performed for survival status: alive versus death. A *p*-value of <0.05 was considered statistically significant. Multiple logistic regression was performed to determine survival predictors. Cox's proportional hazards model was used to calculate the Hazard ratio (HR) for assessing risk factors associated with survival and death.

Ethical Consideration

Ethics approvals were obtained from the Health Research Ethics Committee of Universitas Indonesia Hospital (0058/SKPE/KKO/2021/00).

Results

A total of 285 patients were included, and RT-PCR confirmed the diagnosis in a respiratory sample. The median age was 47.93 ± 15.74, patient in hospitalized patients was older than the non-hospitalized patient (52.02 ± 14.65 vs. 34.06 ± 10.58, $p = 0.000$) without gender discrimination ($p = 0.401$). 65.3% of patients recruited had no comorbidity. The majority of the hospitalized patients with comorbidities ($p = 0.000$), those with hypertension ($p = 0.002$), and diabetes ($p = 0.001$) are shown in **Table 1**. Most hospitalized patients were moderate and severe type, while hospitalized patients with mild type were pregnant and post-partum women.

Table 1 Baseline characteristic of patients with COVID-19 in Lahat Hospital

Variable	All patients, *n* %	Non-hospitalized	Hospitalized	*p-value*
	N = 285	*N* = 65	*N* = 220	
Age (Mean±SD)	47.93 ± 15.74	34.06 ± 10.58	52,02 ± 14.65	0.000[d]
Gender (%)				0.401[c]
Male	136 (47.7%)	28 (43.1%)	108 (49.1%)	
Female	149 (52.3%)	37 (56.9%)	112 (50.9%)	
Comorbidities (%)				0.000[a]
Non-comorbidities	186 (65.3%)	59 (90.8%)	127 (57.7%)	
With comorbidities	99 (34.7%)	6 (9.2%)	93 (42.3%)	
Comorbidities Type				
Hypertension	55 (19.3%)	6 (9.2%)	49 (22.3%)	0.020[c]
Diabetes mellitus	53 (18.6%)	2 (3.1%)	51 (23.2%)	0.001[a]
Heart Disease	5 (1.8%)	-	5 (2.3%)	0.592[c]
Asthma	3 (1.1%)	-	3 (1.4%)	0.799[a]
Hepatitis	4 (1.4%)	-	4 (1.8%)	0.621[a]
CKD	3 (1.1%)	-	3 (1.4%)	0.799[a]
Others	8 (2.8%)	-	8 (3.6%)	0.258[a]
Pregnant women	9 (3.2%)	-	9 (4.1%)	0.217[c]
Post-Partum women	6 (2.1%)	-	6 (2.7%)	0.342[c]
Disease Severity				0.000[b]
Mild	80 (28.1%)	65 (100%)	15 (6.8%)	
Moderate	106 (37.2)	-	106 (48.2%)	
Severe	99 (34.7%)	-	99 (45%)	
The Vital Sign (Mean±SD)				
SBP (mmHg)	133.48 ± 18.56	133.26 ± 17.71	133.55 ± 18.82	0.368[d]
DBP (mmHg)	84.55 ± 12.24	86.23 ± 15.77	84.05 ± 13.76	0.998[d]
Temperature (°C)	37.19 ± 1.03	36.67 ± 1.25	37.37 ± 0.90	0.000[d]
Oxygen saturation (%)	89.6 ± 15.79	97.48 ± 1.17	86.58 ± 17.20	0.000[d]
Respiration rate (bpm)	26.38 ± 7.12	20.32 ± 1.73	28.17 ± 7.12	0.000[d]
Pulse (bpm)	97.13 ± 14.25	90.49 ± 9.32	99.10 ± 14.86	0.000[d]
Clinical Features (Mean±SD)				
Hemoglobin (g/dL)	13.16 ± 2.11	13.85 ± 1.46	12.97 ± 2.23	0.009[d]
Haematocrit (%)	39.23 ± 6.16	41.54 ± 3.86	38.56 ± 6.52	0.001[d]
Erythrocyte (%)	4.58 ± 0.70	4.80 ± 0.42	4.51 ± 0.75	0.002[d]
MCV/HER (Fl)	85.94 ± 6.41	86.62 ± 5.76	85.76 ± 6.57	0.162[d]
MCH/HER (pg)	28.80 ± 2.47	28.87 ± 2.32	28.79 ± 2.50	0.722[d]
MCHC/KHER (g/dL)	33.55 ± 1.37	33.31 ± 1.07	33.61 ± 1,44	0.142[d]
RDW-CV (%)	13.71 ± 1.88	13.16 ± 1.08	13.85 ± 2.03	0.006[d]
WBC (10^9/L)	9.48 ± 6.05	8.10 ± 3.33	9.87 ± 6.59	0.078[d]
Thrombocyte (10^9/L)	257.99 ± 147.23	328.58 ± 238.74	246.40 ± 96.92	0.000[d]
Treatment (%)				
Oseltamivir	92 (32.3%)	30 (46.2%)	62 (28.2%)	0.010[c]
Azithromycin	148 (51.9%)	55 (84.6%)	93 (42.3%)	0.000[a]
Favipiravir	126 (44.2%)	8 (12.3%)	118 (53.6%)	0.000[a]
Levofloxacin	97 (34%)	6 (9.2%)	91 (41.4%)	0.000[a]
Remdesivir	49 (17.2%)	-	49 (22.3%)	0.000[a]
Length of Stay/LoS (Mean±SD)			9.41 ± 4.77	
Outcome				0.000[b]
Alive	227 (78.6%)	65 (100%)	162 (73.6%)	
Death	49 (17.2%)	-	49 (22.3%)	
Transferred to other hospitals	9 (3.2%)	-	9 (4.1%)	

[a]Continuity Correction, [b]Pearson Chi-Square, [c]Fisher's Exact test, [d]Mann Whitney test
CKD, Chronic Kidney Disease; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; MHC, Mean Corpuscular Values; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; RDW-CV, Red Cell Distribution Width; WBC, white blood cell

Table 2 Characteristic and laboratory parameters of hospitalized patients with COVID-19

Variables	All patients	Mortality		*p-value*
	N = 211	Death	Alive	
		N = 49	*N* = 162	
Age (Mean±SD)	51.56 ± 14.46	62.57 ± 9.16	48.23 ± 14.13	0.000[d]
Gender (%)				0.416[c]
Male	104 (49.3%)	27 (25.96%)	77 (74.04%)	
Female	107 (50.7%)	22 (20.56%)	85 (79.44%)	
Comorbidities (%)				0.000[c]
Non-comorbidities	123 (58.3%)	17 (13.82%)	106 (86.18%)	
With comorbidities	88 (41.7%)	32 (36.26%)	56 (63.64%)	
Comorbidities Type				
Hypertension	45 (21.3%)	18 (40%)	27 (60%)	0.005[c]
Diabetes mellitus	51 (24.2%)	20 (39.22%)	31 (60.78%)	0.004[c]
Heart Disease	5 (2.4%)	1 (20%)	4 (80%)	1.000[c]
Asthma	3 (1.4%)	-	3 (100%)	0.787[a]
Hepatitis	4 (1.9%)	1 (25%)	3 (75%)	1.000[c]
CKD	3 (1.4%)	2 (66.77%)	1 (33.33%)	0.269[a]
Others	7 (3.3%)	3 (42.9%)	4 (57.1%)	0.205[c]
Pregnant Women	9 (4.3%)	-	9 (100%)	0.200[a]
Post-Partum women	6 (2.8%)	-	6 (100%)	0.381[a]
Disease Severity				0.000[b]
Mild	15 (7.1%)	-	15 (100%)	
Moderate	106 (50.2%)	-	106 (100%)	
Severe	90 (42.7%)	49 (54.4%)	41 (45.6%)	
The Vital Sign (Mean±SD)				
SBP (mmHg)	132.90 ± 18.31	139.55 ± 21.15	130.88 ± 16.93	0.012[d]
DBP (mmHg)	83.86 ± 13.82	85.39± 15.85	83.40 ± 13.17	0.439[d]
Temperature (°C)	37.35 ± 0.90	37.53 ± 1.18	37.29 ± 0.80	0.015[d]
Oxygen saturation (%)	86.83 ± 17.09	66.82 ± 23.51	92.88 ± 7.58	0.000[d]
Respiration rate (bpm)	27.88 ± 7.05	34.92 ± 6.77	25.75 ± 5.61	0.000[d]
Pulse (bpm)	98.86 ± 15.08	108.10 ± 13.97	96.07 ± 14.30	0.000[d]
Clinical Features (Mean±SD)				
Hemoglobin (g/dL)	12.97 ± 2.23	12.65 ± 2.25	13.06 ± 2.14	0.238[d]
Hematocrit (%)	38.60 ± 6.34	37.81 ± 6.42	38.84 ± 6.31	0.242[d]
Erythrocyte (%)	4.52 ± 0.72	4.45 ± 0.73	4.54 ± 0.73	0.505[d]
MCV/HER (Fl)	85.70 ± 6,62	85.12 ± 6.42	85.87 ± 6.69	0.481[d]
MCH/HER (pg)	28.73 ± 2.51	28.47 ± 2.42	28.82 ± 2.54	0.427[d]
MCHC/KHER (g/dL)	33.58 ± 1.45	33.45 ± 1.31	33.62 ± 1.49	0.427[d]
RDW-CV (%)	13.82 ± 2.04	14.43 ± 2.14	13.64 ± 1.97	0.000[d]
WBC (10^9/L)	9.75 ± 6.58	13.34 ± 6.53	8.65 ± 6.21	0.000[d]
Thrombocyte (10^9/L)	236.65 ± 97.56	243.73 ± 101.42	234.51 ± 96.59	0.678[d]
Basophil (%)	0.199 ± 0.185	0.149 ± 0.139	0.217 ± 0.196	0.034[d]
Eosinophil (%)	0.398 ± 0.720	0.198 ± 0.422	0.470 ± 0.790	0.002[d]
Neutrophil (%)	74.49 ± 11.98	81.38 ± 7.95	72.03 ± 12.23	0.000[d]
Lymphocyte (%)	17.46 ± 10.61	11.57 ± 6.74	19.56 ± 10.96	0.000[d]
Monocyte (%)	7.45 ± 3.12	6.71 ± 2.55	7.72 ± 3.27	0.107[d]
NLR	7.09 ± 11.74	13.26 ± 18.60	6.24 ± 7.23	0.000[d]
AST (U/L)	56.74 ± 45.53	72.76 ± 60.06	51.75 ± 38.88	0.007[d]
ALT (U/L)	48.80 ± 37.95	54.05 ± 35.47	47.23 ± 38.65	0.220[d]
BUN (mg/dL)	47.46 ± 37.22	80.17 ± 46.10	36.78 ± 26.28	0.000[d]
Creatinine (mg/dL)	1.53 ± 4.55	2.86 ± 9.02	1.11 ± 0.97	0.000[d]
Blood Glucose (mg/dL)	180.13 ± 133.19	253.15 ± 191.84	157.25 ± 98.82	0.000[d]
Sodium (mmol/L)	133.55 ± 5.84	133.64 ± 6.44	133.45 ± 5.68	0.747[d]
Potassium (mmol/L)	3.94 ± 0.59	4.33 ± 0.65	3.80 ± 0.50	0.000[d]
Chloride (mmol/L)	100.54 ± 6.41	101.17 ± 7.00	100.32 ± 6.20	0.665[d]
Treatment (%)				
Oseltamivir	61 (28.9%)	10 (16.39%)	51 (83.61%)	0.153[c]
Azithromycin	92 (43.6%)	24 (26.1%)	68 (73.9%)	0.414[c]
Favipiravir	113 (53.6%)	16 (14.2%)	97 (85.8%)	0.001[c]
Levofloxacin	85 (40.3%)	19 (22.4%)	66 (77.6%)	0.869[c]
Remdesivir	45 (21.3%)	23 (51.1%)	22 (48.9%)	0.000[a]
Length of stay/ LOS (Mean±SD)	9.49 ± 4.77	5.39 ± 3.78	10.73 ± 4.33	0.000[d]

[a]Continuity Correction, [b]Pearson Chi-Square, [c]Fisher's Exact test, [d]Mann Whitney test
CKD, Chronic Kidney Disease; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; MHC, Mean Corpuscular Values; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; RDW-CV, Red Cell Distribution Width; WBC, white blood cell; NLR, neutrophil-lymphocyte ratio; AST, Aspartate aminotransferase; ALT, Alanine aminotransferase; BUN, blood urea nitrogen.

Table 1 also demonstrates a comparison between hospitalized and non-hospitalized in terms of admission vital signs. The non-hospitalized group showed a significantly lower mean for temperature (p = 0.000), respiration rate (p = 0.000), and pulse (p = 0.000) but still in the normal range and a significantly higher median for admission oxygen saturation (97.48 ± 1.17 vs. 86.58 ± 17.20, p = 0.000). No significant difference in admission systolic (p = 0.368) and diastolic (p = 0.998) blood was observed between hospitalized and non-hospitalized. On clinical features, the difference in mean between hospitalized and non-hospitalized patients was most significant except in MCV, MCH, MCHC, and white blood cells. Non-hospitalized patients had higher hemoglobin (p = 0.009), hematocrit (p = 0.001), erythrocyte (p = 0.002), and the thrombocyte count (p = 0.000) but lower in RDW-CV count (p = 0.006). The treatment performed is also presented in **Table 1**. The use of antiviral (Oseltamivir, Favipiravir, and Remdesivir) and antibacterial (Azithromycin and Levofloxacin) were statistically significant between hospitalized and non-hospitalized groups. The outcome of the hospitalized group was that 22.3% died, and 4.2% were transferred to another hospital (p = 0.000).

The median age of patients who survived was significantly different from those who died in the hospitalized group, 48.23 ± 14.13 vs. 62.57 ± 9.16 (**Table 2**). In addition, 49.3% of the hospitalized patient were males. The underlying comorbidities were hypertension and diabetes, which were statistically significant. 90 (42.7%) of the hospitalized patient was severe group, 49 (54.4%) was dead, and 41 (45.6%) survived.

The vital sign during hospitalization showed significant statistical differences in systole blood pressure, temperature, oxygen saturation, respiration rate, and pulse between dead and alive groups. Survival patients had lower RDW-CV count compared to non-survival patients (median, 13.64 vs. 14.43, p = 0.000), lower WBC (median, 13.34 vs. 8.65, p = 0.000), lower neutrophil rates (median, 81.38 vs. 72.03, p = 0.000) and lower NLR ratio (median, 13.26 vs. 624, p = 0.000) but higher in lymphocyte (median, 11.57 vs. 19.56, p = 0.000), basophil (median, 0.15 vs. 0.22, p = 0.034) and eosinophil (median, 0.20 vs. 0.47, p = 0.002). Other hematological features such as hemoglobin, hematocrit, erythrocyte, MCV, MCH, MCHC, thrombocyte, and monocyte show no difference between the alive and death group. Non-survival patients had higher AST (median 72.76 vs. 0.007, p = 0.007), BUN (median 80.17 vs. 36.78, p = 0.000), creatinine (median 2.86 vs. 1.11, p = 0.000), blood glucose (median 253.15 vs. 157.25, p = 0.000), and blood potassium (median 4.33 vs. 3.80, p = 0.000) were statistically different from the survival group.

Only the use of favipiravir and remdesivir was significant between the alive and death group. The mean length of stay for all patients was 9.49 ± 4.77days. The mean duration was 10.73 ± 4.33 days for the survival group and 5.39 ± 3.78 days for the non-survival group (p = 0.000).

Table 3 Multiple logistic regression – predictors of mortality

Variables	B	*p*-value	Hazard Ratio	95% CI for Hazard Ratio	
				Lower	Upper
Age, years	0.053	0.060	1.054	0.998	1.114
Comorbidities	-0.255	0.752	0.775	0.160	3.765
Hypertension	-0.458	0.533	0.633	0.150	2.667
Diabetes mellitus	0.914	0.185	2.494	0.645	9.646
SBP	0.013	0.336	1.013	0.986	1.041
Temperature	-0.095	0.634	0.909	0.615	1.345
Oxygen saturation	-0.021	0.114	0.979	0.954	1.005
Respiration rate	0.145	0.030	1.156	1.014	1.318
Pulse	0.048	0.066	1.049	0.997	1.103
RDW-CV	0.007	0.955	1.007	0.785	1.293
WBC	0.140	0.003	1.150	1.050	1.260
Basophil	2.015	0.377	7.500	0.086	657.298
Eosinophil	0.555	0.466	1.742	0.392	7.737
Neutrophil	0.090	0.390	1.094	0.891	1.344
Lymphocyte	-0.036	0.751	0.964	0.771	1.206
NLR	-0.114	0.128	0.893	0.771	1.033
AST	0.007	0.168	1.007	0.997	1.018
BUN	0.020	0.026	1.021	1.002	1.039
Creatinine	-0.077	0.836	0.926	0.449	1.911
Blood Glucose	0.000	0.876	1.000	0.996	1.003
Potassium	-0.122	0.811	0.885	0.326	2.404
Favipiravir	0.703	0.418	2.020	0.369	11.059
Remdesivir	-0.474	0.479	0.622	0.168	2.311

SBP, Systolic Blood Pressure; RDW-CV, Red Cell Distribution Width; WBC, white blood cell; NLR, neutrophil-lymphocyte ratio; AST, Aspartate aminotransferase; BUN, blood urea nitrogen

Multiple logistic regression analysis using Cox regression analysis determined respiration rate, WBC, and blood urea nitrogen as predictors of mortality (**Table 3**). The increasing number of respiration rate (p = 0.030), WBC (p = 0.003), and blood urea nitrogen (BUN) (p = 0.026) would increase the mortality risk (hazard ratio). We constructed a Kaplan-Meier plot for the effect of comorbidities, favipiravir, and remdesivir on LOS (**Figure 2**). The result revealed that comorbidities, Favipiravir, and Remdesivir had a significantly prolonged LOS compared with non-comorbidities and those without Favipiravir and Remdesivir.

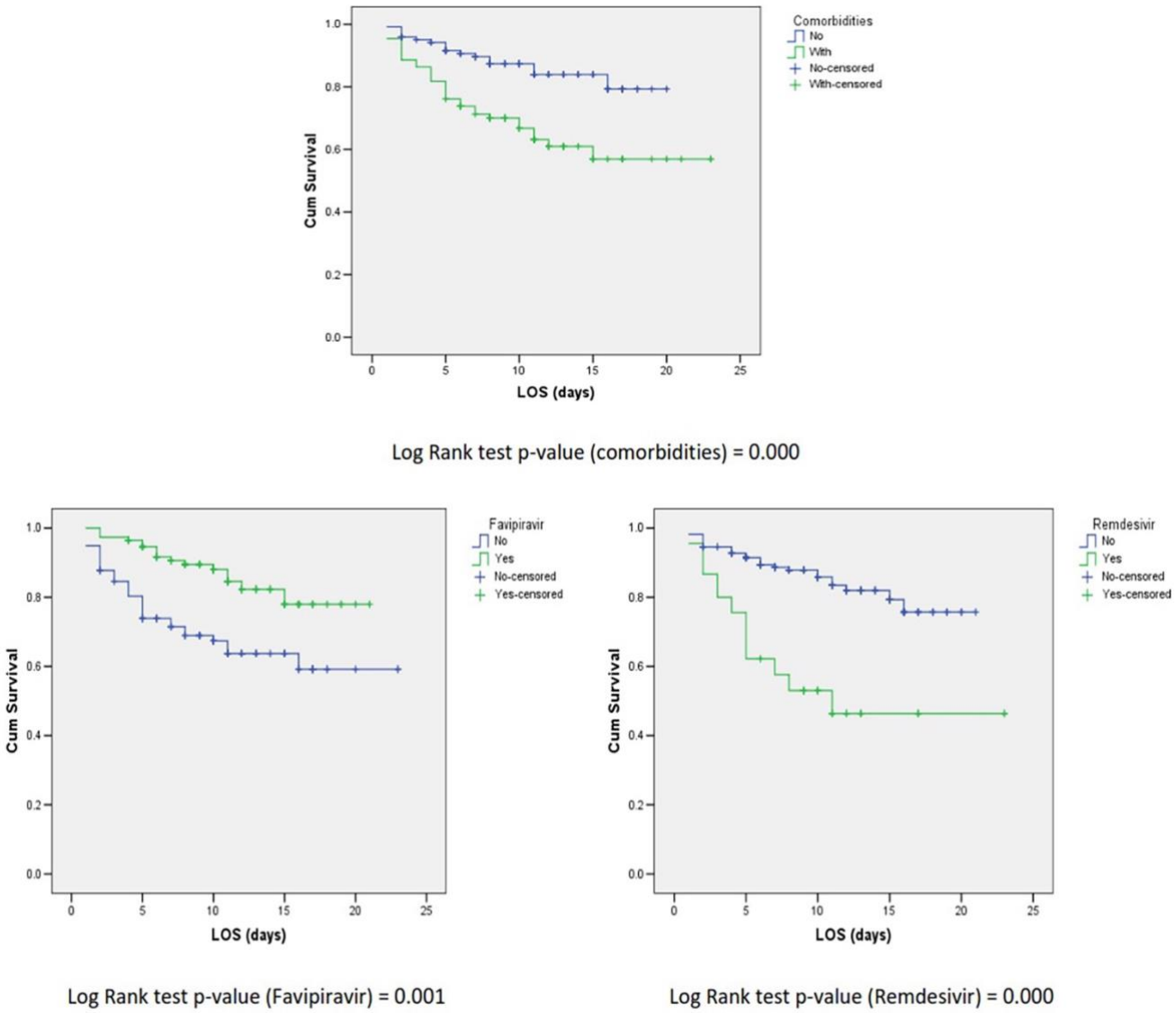

Figure 2 Kaplan-Meier plot for the impact of comorbidities, favipiravir, and remdesivir on length of stay (LOS)

Discussion

The relationship between various demographic and clinical features was portrayed in caring for patients with COVID-19. Ages were prominently higher between hospitalized patients (>38 years) than between younger ones (≤44 years) and higher in death than alive patients. Age has been considered a key factor since the start of the pandemic. Studies have consistently shown a mortality increase related to age. In addition, the elderly population is at higher risk of developing adverse complications than their peers (Bonanad et al., 2020; Tiruneh et al., 2021). Delirium, syncope, and coma are more likely in the elderly than in younger patients with COVID-19, while the incidence of loss of smell, hearing loss, and headache decreases with age (Pereira et al., 2022).

Patients with any comorbidity yielded poorer clinical outcomes than those without comorbidity. Our findings also showed that hospitalization numbers were significantly larger in diabetes and hypertension patients. Comorbidities were also found to be risk factors for death from COVID-19. Patients with hypertension and cardiovascular disease are particularly susceptible to SARS-CoV-2 due to low ACE2 expression (Ashktorab et al., 2022). A comorbid background predisposes the illness to multisystem organ dysfunction, and eventually dies from nasty COVID-19. Study shows the impact of comorbidities on the immune system. Syndromes (obesity, hypertension, and diabetes) affect distinct immune populations, patients with comorbid conditions affecting the lungs or heart, and metabolic syndrome factors. In contrast, immune abnormalities and kidney dysfunction have a specific immune profile in SARS-CoV-2 infection (Kreutmair et al., 2022). In this study, other comorbidities such as heart disease, asthma, hepatitis, and CKD are insignificant due to the lack of sample size.

In this study, there were differences in vital signs such as temperature, oxygen saturation, respiration rate, and pulse between the non-hospitalized and hospitalized groups and the alive and death groups. Patients with COVID-19 who weakened in the medical facility were introduced quickly, demolishing respiratory disappointment, low SpO2 (Oxygen saturation.), and high FiO2 (Fraction of Inspired Oxygen), yet just gentle irregularities in vital signs. These data may affect early warning score identification for deteriorating patients (Pimentel et al., 2020). Decreasing oxygen saturation, short

respiration, weak diastolic blood pressure, and elevated glucose levels are fundamentally associated with mortality and become components of an encouraging prediction model (Ikram & Pillay, 2022).

A comparison of hematological results showed that the neutrophil count, white blood cell count (WBC), red distribution width (RDW-CV), and NLR ratio were more significant in the death group. Otherwise, the death cluster had lower basophil, eosinophil, and lymphocyte counts than the survivors. This conclusion is consistent with previous studies for patients with COVID-19 (Al Houri et al., 2022; Bairwa et al., 2021; Lozano et al., 2022). WBC number at the hospital beginning was significantly associated with mortality. Therefore, greater attention should be paid to higher WBC counts when treating COVID-19 (Zhu et al., 2021). In this study, deceased patients had significantly increased white blood cell counts. Therefore, an elevated WBC in severe patients indicates a higher risk of clinical worsening and adverse outcomes. In most studies, lymphopenia was one of the most widely recognized clinical elements related to mortality in COVID-19 patients. It has been suggested that the connection between viral load and reduced lymphocyte levels may be explained by the activation of an immune response that overproduces pro-inflammatory cytokines and contributes to uncontrolled inflammation in severe patients with COVID-19 (Lozano et al., 2022).

Our data showed the high mean of ALT, BUN, creatinine, and Potassium linked with increased mortality risk. Likewise, a previous study found that BUN, creatinine, procalcitonin, ferritin, CRP, and D-dimer were differentially managed in COVID-19. These laboratory values serve as clinical indicators and help estimate disease severity in the population (Cheng et al., 2020; Damiati et al., 2022; Ke et al., 2021). Patients with COVID-19, especially critically ill patients, have impaired liver and kidney functions (Liu et al., 2021; Qu et al., 2021). In people with diabetes, high levels of ALT and BUN are related to a higher risk of death (Borzouei et al., 2021). Dynamic changes in three markers of kidney function are associated with variable seriousness and unfortunate forecast in patients with COVID-19. BUN points out a strong correlation and potential to anticipate unfriendly results in patients with COVID-19 after seriousness stratification and classification (Liu et al., 2021), similar to our result.

Changes in local guidelines significantly impact hospital stays for patients with COVID-19 in Indonesia. Symptom-based strategies can shorten hospital stays, especially in patients with mild diseases. The shorter hospital stay had several benefits, including allocating much-needed beds and lowering costs for those admitted. Management protocols for COVID-19 in Indonesia published by Health Ministry were used to classify COVID-19 severity and pharmacotherapy guideline. The use of drug treatment in this study (Oseltamivir, favipiravir, remdesivir, azithromycin, and levofloxacin) refers to national guidelines according to the severity of the patient (Burhan et al., 2020). A systematic review found that antibiotic cocktails are widely used, despite the lack of efficacy against COVID-19 infection, especially at the beginning of the pandemic (Chedid et al., 2021). Clinical trials for antiviral drugs to evaluate effectiveness and safety are ongoing. Favipiravir has significantly improved the clinical status and recuperation of patients with COVID-19 in the beginning phases of infection (Rahman et al., 2022). Although remdesivir had made no tremendous difference on other hospitalized patients with COVID-19 already on ventilators, the effect on death was negligible (WHO Solidarity Trial Consortium, 2022).

Our research has the following shortcomings. Firstly, because our study was a retrospective and single center, the researchers were unable to collect complete data from the patients. Secondly, being a tertiary referral local hospital at a small regency in South Sumatra with a lower population density than in Java could affect the outcome. Notwithstanding, any bias for information due to vanishing data is mitigated by guiding the hospital's clinical pathway for patients with COVID-19 whose clinical information has been captured by the system. The study was conducted during the first and second waves of the COVID-19 pandemic, so the different virus variants can also affect differences in clinical data, treatments, and outcomes. Finally, patients vaccinated before contracting COVID-19 will also give different results. Therefore, these results may not be generalizable due to contrasts between populations, medical clinic approaches, clinical practice, and in the degree of local transmission.

Implications for Healthcare Policy and Practice

Several biomarkers found in this study might serve as early warning and prognostic indicators of severe illness and death from COVID-19 in high-risk patients, especially elderly patients with multiple comorbidities. However, in the context of the national health care system, there are differences in facilities and human resources in various regions in Indonesia, so extra attention is needed to use the predictive power of these biomarkers to stratify high-risk patients in hospitals to improve the efficacy and outcome for the COVID-19 treatment. In addition, this study helped uncover nursing care difficulties related to the COVID-19 clinical illness process because nurses are one of the front-line components of health workers and play a crucial role in managing this pandemic.

Conclusion

This study sheds light on various attributes and prognostic elements of hospitalization and gives experiences into the primary drivers of serious COVID-19 in a tertiary referral hospital by contrasting surviving and non-surviving patients. Furthermore, our study's fundamental finding is that laboratory measurements such as white blood cells, blood urea nitrogen, and respiratory rate in vital signs are biomarkers that can act as early advance notice and prognostic marks of extreme illness and mortality. Importantly, these laboratory features serve as clinical predictors that can help assess disease seriousness in a population, as age and comorbidities are important factors influencing the severity of COVID-19. Therefore, future examinations ought to remember more patients with COVID-19 and other populations in Indonesia for further investigation.

Declaration of Conflicting Interest

None.

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Authors' Contributions

Conceived and designed the research: AM and NFS; Performed the research: DM and IF; Analyzed the data: DM and NFS; Wrote the manuscript: DM, AM, IF, and NFS; and Final Approval: DM, AM, IF, and NFS. All authors met the authorship criteria.

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Data Availability

Datasets are available from the corresponding author upon reasonable request.

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