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Overview of Oxygen Saturation in COVID-19 Patients in the Isolation Ward of Negara General Hospital

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ABSTRACT

Introduction. *Coronavirus Disease 2019 (COVID-19) is a contagious respiratory system infection caused by a new type of Coronavirus. COVID-19 infection can cause mild, moderate, or severe symptoms in the form of fever, tachypnea, severe respiratory distress, and hypoxemia. Oxygen saturation is an indicator of oxygenation status. Hypoxemia is an important prognostic indicator of hospital length of stay and death.* ***Objectives.*** *To determine the description of oxygen saturation in COVID-19 patients during treatment in the Isolation Ward of Negara General Hospital.* ***Methods.*** *Descriptive study with a retrospective approach, to examine the medical records of COVID-19 patients with moderate and severe symptoms.* ***Results.*** *The number of COVID-19 patients treated in the Isolation Ward of Negara General Hospital during the 2020-2022 study was 384 patients. Most of them had moderate symptoms (70.05%). SpO2 values <93% were found more frequently in men (51.11%) and in the age group 41-60 years (49.63%). Comorbid DM was more commonly found at SpO2 values <93% (23.02%) and pneumonia was more common at SpO2 values <93% (97.21%).* ***Conclusions.*** *Patients with SpO2 values <93% were more likely to be male patients, age group 41-60 years, with comorbid DM and pneumonia. Women's immune systems are superior to men's due to hormonal protection. Hypertension and diabetes mellitus are low-grade inflammation (systemic inflammatory processes) and cause more severe organ damage. An increase in pro-inflammatory cytokines in serum is associated with inflammation in the lungs, causing pneumonia.*

Introduction

The World Health Organization has named the new type of beta coronavirus that causes pneumonia as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), with the corresponding name of Coronavirus Disease 2019 or COVID-19 (Burhan et al., 2020). COVID-19 infection can cause mild, moderate or severe symptoms. The main clinical symptoms that appear are fever, cough and difficulty breathing. In severe cases the deterioration is rapid and progressive, such as ARDS (Fatoni & Rakhmatullah, 2021). Signs that appear are tachypnea (breathing frequency: >30x/minute), severe respiratory distress or hypoxia with the patient's oxygen saturation <90% outside air (Burhan et al., 2020) (Burhan et al., 2022).

Some COVID-19 patients experience silent hypoxia where the patient does not appear short of breath even though peripheral oxygen saturation measurements are below normal values. This condition is known as happy hypoxemia or silent hypoxemia, namely a condition that has not been reported before the ARDS incident. The results of Suryaningsih et al. in 2022 study regarding the prevalence of silent hypoxia in confirmed COVID19 patients at Sanglah Hospital Denpasar showed that 237 people (52.8%) of the 449 respondents showed signs of silent hypoxia while 212 people (47.2%) of respondents did not shows signs of silent hypoxia (Suryaningsih et al., 2022).

Shortness of breath due to hypoxemia, or low blood oxygen levels, is the most common symptom in COVID-19 patients, and it is a crucial indicator for determining the length of hospital stay, ICU care, intubation, and mortality rate (Swenson & Hardin, 2023). Increased respiratory

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frequency and worsening peripheral oxygen saturation, along with dyspnea, are warning signs of clinical deterioration that may indicate the need for respiratory support, such as a mechanical ventilator.

Monitoring peripheral oxygen saturation is an effective approach to detecting clinical deterioration in patients without clinical dyspnea (Busana et al., (2021). Therefore, the patient's respiratory condition, especially oxygen saturation, is monitored using a pulse oximetry device. Based on the above, this research was conducted to describe oxygen saturation in COVID-19 patients during treatment in the Isolation Ward of Negara General Hospital therefore plans can be prepared for treating similar patients.

Methods

This study utilizes a descriptive, retrospective approach by examining the medical records of COVID-19 patients who exhibited moderate or severe symptoms and received treatment in the Isolation Ward of Negara General Hospital between 2020 and 2022. During 2020-2022, COVID-19 cases in the Isolation Ward of Negara General Hospital reached 1110 people. The research took place from November 8th to December 5th, 2023, and was conducted in the Medical Records Department of Negara General Hospital with 384 samples. The data analysis method involved calculating the percentage of oxygen saturation levels based on COVID-19 symptoms. Oxygen saturation is monitored using a pulse oximetry device. Data was collected using a data collection sheet containing data on characteristics and oxygen saturation

Results

The number of COVID-19 patients studied from 2020 to 2022 was 384 patients. The characteristics of the research subjects, COVID-19 patients who were treated in the Isolation Ward of Negara General Hospital, can be seen in Table 1.

Table 1 Frequency Distribution of Characteristics of Research Subjects for COVID-19 Patients in the Isolation Ward of Negara General Hospital

Variable		f (n=384)	%
Gender	Male	204	53.13
	Female	180	46.88
Age Group	<18 years old	8	2.08
	18-40 years old	59	15.36
	41-60 years old	181	47.14
	>60 years old	136	35.42
Number of Comorbidities	None	191	49.74
	1 Comorbidity	140	36.46
	≥2 Comorbidities	53	13.80
Major Comorbidity	None	191	49.74
	Hypertension	47	12.24
	Diabetes	74	19.27
	Heart Disease	25	6.51

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	Kidney Disease	15	3.91
	Pulmonary Disease	20	5.21
	Liver Disease	2	0.52
	Stroke	5	1.30
	HIV	5	1.30
Pneumonia	Without Pneumonia	17	4.43
	With Pneumonia	367	95.57
Length of Stay	≤10 Days	306	79.69
	>10 Days	78	20.31

According to the data, male patients had a higher frequency of SARS-CoV-2 infection at 53.13%, with female patients at 46.88%. The age group with the most cases was 41-60 years old, accounting for 47.14% of patients. Diabetes was the most common comorbidity, affecting 19.27% of patients. Most patients, 70.1%, experienced moderate COVID-19 symptoms, while 20.9% had severe symptoms. Pneumonia was present in 95.6% of patients. A shorter length of stay, ≤10 days, was observed in 79.69% of patients. The characteristics of the research subjects, COVID-19 patients based on the severity of COVID-19 symptoms can be seen in Table 2.

Table 2 Frequency Distribution of Research Subject Characteristics
Based on the Severity of COVID-19 Symptoms in the Isolation Ward of Negara General Hospital

Variable		**Severity of COVID-19 Symptoms**			
		Moderate (n=269)		**Severe (n=115)**	
		f	**%**	**f**	**%**
Gender	Male	142	52.79	62	53.91
	Female	127	47.21	53	46.09
Age Group	<18 years old	7	2.60	1	0.87
	18-40 years old	49	18.22	10	8.70
	41-60 years old	123	45.72	58	50.43
	>60 years old	90	33.46	46	40.00
Number of Comorbidities	None	134	49.82	57	49.57
	1 Comorbidity	105	39.03	35	30.43
	≥2 Comorbidities	30	11.15	23	20.00
Diabetes	Without Diabetes	221	82.16	89	77.39
	With Diabetes	48	17.84	26	22.61
Pneumonia	Without Pneumonia	16	5.95	1	0.87
	With Pneumonia	253	94.05	114	99.13
Length of Stay	≤10 Days	207	76.95	99	86.09
	>10 Days	62	23.05	16	13.91

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In the severe group, there were 62 male patients (53.91%), and in the moderate group, there were 142 male patients (52.79%). The age group with the highest number of patients was 41-60 years, with 58 patients (50.43%) in the severe group. Patients with two or more comorbidities were more likely to have severe symptoms, with 23 patients (20.00%) falling into this category. Of those with comorbidities, diabetes was the most common and severe, affecting 26 patients (22.61%). Pneumonia was also more severe, affecting 114 patients (99.13%).

Discussion

According to the data, a greater number of COVID-19 patients were men, representing 204 individuals (53.13%), with the age group of 41-60 years accounting for 181 patients (47.14%). Furthermore, men and the age group 41-60 years were found to have lower oxygen saturation levels (SpO2) <93%, respectively. In terms of severity, male patients made up the majority in the severe degree group, totaling 62 patients (53.91%), while the age group of 41-60 years had 58 patients (50.43%) in the same category. These findings are consistent with previous research conducted by (Radwan et al., 2020), (Guan et al., 2020), (Karya, K. W. S. et al., 2021) (Putra & Fenty, 2022) demonstrating that COVID-19 primarily affects individuals from the productive age group to the elderly. Moreover, research suggests that men are more susceptible to contracting SARS-CoV-2 and have lower life expectancy than women. This may be attributed to women's superior hormonal protection and immune system, which can eliminate viruses more effectively. However, it is important to note that some women's immune systems may experience a decline due to pregnancy and childbirth. Consequently, better hygiene practices and self-protection behavior may be critical for women to prevent COVID-19 infection (Chang, 2020).

Hypertension and diabetes mellitus are two comorbidities that are commonly associated with COVID-19. These conditions are characterized by low-grade inflammation that can contribute to the severity of COVID-19. When left uncontrolled, these conditions can lead to the progression of COVID-19 and more severe organ damage. Individuals with diabetes may also experience cardiovascular disease and nephron-vascular disease, which can increase the risk of mortality from COVID-19. Elevated glucose levels may also contribute to the severity of COVID19 by enhancing viral replication. This process is maintained through mitochondrial reactive oxygen production and hypoxia-induced activation of factor 1α. Hyperglycemia is an independent predictor of morbidity and mortality in COVID-19 patients. Conversely, COVID-19 can also worsen glucose control in diabetic patients, leading to an increased need for insulin (Pal & Bhadada, 2020) (Lim et al., 2021).

Inflammation is a common occurrence in COVID-19 patients and can manifest in various forms, including diffuse alveolar damage and infiltration of inflammatory cells. This inflammation can also affect other organs such as the liver, brain, and pancreas. The high inflammatory burden can cause a decrease in the function of muscle cells and the liver, which play a major role in insulin-mediated glucose uptake. During an inflammatory cytokine storm, this uptake process decreases, causing uncontrolled hyperglycemia. The results showed that pneumonia was found in 367 patients (95.57%). Pneumonia was found more frequently in the severe group, namely 114 patients (99.13%) than in the moderate group, namely 253 patients (94.05%). Pneumonia was found more frequently in the lower saturation group, namely 135 patients (97.21%). Studies on SARS show the virus replicates in the lower respiratory tract followed by an innate and specific immune system response. In the early stages, there is diffuse alveolar damage, macrophages, T cell infiltration, and type 2 pneumocytes proliferation, followed by infiltrative changes or

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widespread consolidation in the lungs. Elevated pro-inflammatory cytokines in serum are associated with inflammation in the lungs and extensive damage to lung tissue in patients with SARS. The new coronavirus produces antigen variations that can cause pneumonia (Burhan et al., 2020)

The study found that 269 patients (70.1%) experienced moderate COVID-19 symptoms, while 115 patients (20.9%) experienced severe symptoms. These findings align with Karya et al., 2021 research, which found an average oxygen saturation of 95%. Men (51.08%) and individuals aged 41-60 (50.36%) were more likely to exhibit lower oxygen saturation levels. Coronaviruses can cause respiratory infections, including pneumonia, and dyspnea is a common symptom of serious illness related to hypoxemia. As dyspnea and hypoxemia progress, respiratory failure can occur, and low oxygen saturation can lead to decreased physiological performance. Multiple factors, such as the severity of COVID-19 spread, body immunity, and preexisting conditions, can contribute to decreased oxygen saturation in COVID-19 patients. A saturation level below 95% can result in hypoxemia or hypoxia, depriving the body of oxygen (Parasher, 2021) (Tompodung et al., 2022).

Conclusion

Between 2020 and 2022, 384 patients were studied in the Isolation Ward of Negara General Hospital for COVID-19. The majority of the patients were men (53.13%) between the ages of 41-60 (47.14%). The most common comorbidity was diabetes (19.27%), particularly in the group experiencing severe COVID-19 symptoms (22.61%). Pneumonia was present in most patients (95.57%), with an even higher occurrence in the severe symptom group (99.13%). Notably, comorbid diabetes was more prevalent in the group with oxygen saturation levels ≤93% (23.02%), while pneumonia was also more common in this group (97.12%). Due to the high risk of COVID-19 infection for diabetic patients and their tendency towards clinical deterioration and hypoxia, optimal blood glucose control and oxygenation therapy should be implemented from the onset of the illness. Pneumonia in COVID-19 infection can lead to alveolar damage and hinder oxygen diffusion, resulting in hypoxia. Therefore, oxygenation therapy should be carefully evaluated, and oxygen saturation levels should be maximized wherever possible. In some cases, a blood gas analysis examination may be necessary to assess the possibility of ARDS or respiratory failure, requiring intensive therapy.

Ethics approval and consent to participate

This research was carried out by tracing medical record documents that had passed ethical clearance and had received permission from the authorized hospital and from the Jembrana district investment and one-stop service office.

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