CASE REPORT

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COVID-19 and the ageing immune system in an elderly patient : a case report

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ABSTRACT

BACKGROUND

The severity of COVID-19 infection has an increasing trend in the elderly, which contributes to the high morbidity and mortality rates in this population. Aging itself is a prominent risk factor for severe disease and death from COVID-19.

CASEDESCRIPTION

This case report a 71-year-old woman who complained of shortness of breath for 3 days before being admitted to the hospital. Bilateral consolidation and increased bronchovascular pattern were found on chest radiograph, and a positive SARS-COV2 nasopharyngeal swab PCR test result was noted. This patient was diagnosed with confirmed severe manifestation of COVID-19, community-acquired pneumonia and type 1 respiratory failure, as well as type II diabetes mellitus and suspicion of acute gastritis. The results of the geriatric status assessment were moderate functional status, risk of malnutrition, and moderate risk of deep vein thrombosis (DVT). This patient underwent treatment in accordance with the COVID-19 protocol along with management for geriatric status improvement. The patient was given permission to return home after 14 days of treatment, during which time her health had improved and her functional status had changed to moderate dependency. During follow-up, the patient continued to receive therapy. She is still being observed and future evaluations will be conducted.

CONCLUSION

The increased susceptibility of the elderly to COVID-19 infection is caused by various factors. A burden of death and long-term disability brought on by this pandemic may be lessened by new or modified therapies that target aging-associated mechanisms. Therefore, COVID-19 case management in this population should be done with a comprehensive approach.

Keywords: COVID-19, geriatric, immunity, pneumonia, woman

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INTRODUCTION

The COVID-19 pandemic that has spread in almost all countries in the world requires clinical and theoretical research related to various populations with different demographic characteristics. Previous studies have reported that chronic comorbidities of diabetes, hypertension, and cardiovascular disease aggravate the infectious condition of the SARS-CoV2 virus.[1] Global molecular studies have narrowed down the pathogenesis of this viral infection to the interface between viral surface proteins and ACE-II receptors on pulmonary alveolar epithelial cells.[1,2] These findings are the reasons for several other factors that strengthen the findings regarding epidemiological data, which generally state that the elderly population is the group that is most affected by or most susceptible to this infection, have a history of comorbidities, and decreased numbers or polymorphisms of ACE-II receptors.[2]

Data from the Centers for Disease Control and Prevention (CDC) reports that although the elderly population, or people over the age of 65, only covers 17% of the total population in the United States, this population accounts for up to 31% of total infections, 45% of hospital admission rates, 53% of rates for intensive care, and 80% of deaths due to COVID-19 infection.[3] In Indonesia until early June 2020 it was shown that the highest proportion of deaths was identified among the elderly (43.8%). The mortality rate indicated a similar trend in which the elderly contributed to the highest rate (17.69%).[4] These data indicate that the severity of COVID-19 infection tends to increase, resulting in higher mortality or more severe clinical manifestations in the elderly population.

Numerous case reports and studies on COVID-19 cases that affect elderly people and other vulnerable groups have been published. These reports and studies demonstrate the evidence of an aging immune system and a decline in both its strength and function. A number of changes to the body's physiological systems occur as a result of the complicated phenomenon of aging. Immunosenescence, one of the most significant changes, affects the immune system. Given that aging is linked to high rates of morbidity and mortality from numerous diseases, the weakened immune function of the elderly is clinically evident.[5] Immunosenescence, or the loss of immune function and diminished immunity to infectious pathogens with aging, is brought on by intricate processes affecting immune cell development and maintenance as well as the origin, maintenance, and termination of appropriately targeted immunological responses.[6]

However, the incidence of post-hospitalization COVID-19 complications, which need additional follow-up and is related to the maturation of the immune system against the COVID-19 virus itself, cannot be explained by the pertinent scientific data. Throughout this case report, it will be clearly explained how to tackle COVID-19 in elderly instances as well as how to treat these patients properly after therapy. The goal of this case report is to learn more about the phenomena that arise in geriatric COVID-19 instances and call for a variety of therapeutic stances. Based on the data above, the authors are interested in knowing about the differences in clinical symptoms as well as the impact of treatment and therapy needed in the elderly with COVID-19 infections.

CASE REPORT

A 71-year-old woman came to the hospital complaining of shortness of breath for 3 days before admission. She complained of coughing up yellow phlegm since 3 days ago. She also complained of fever for 3 days (less than 38°C), she merely laid in bed as she became weaker and weaker. She had a sore throat and experienced a decrease in appetite accompanied by nausea and heartburn. Following questions on secondary infections, cancer, or other related diseases, the patient denied having any illnesses that were related to immunocompromised disorders.

The patient had a history of diabetes mellitus since 2016, but she was not undergoing routine treatment. Physical examination showed that the body mass index (BMI) was 21.5 kg/m$^{(2)}$ and that the patient was compos mentis. The blood pressure was 130/80 mmHg, pulse rate 108 beats per minute, respiratory rate 28 per minute, temperature 37.8°C, and oxygen saturation 90% on room air. There were only additional crackles heard in both lungs on auscultations.

There was consolidation in the upper and lower zones of both lungs with increased bronchovascular markings, an impression of pneumonia (Figure 1). Clinical laboratory findings are shown in Table 1. The patient was diagnosed as having severe COVID-19, community acquired pneumonia (CAP) and type-1 respiratory failure, type-II diabetes mellitus, and suspected acute gastritis. A comprehensive geriatric assessment was mandatory, in which the functional status using the activity of daily living (ADL) Barthel index found the patient to be moderately dependent and without delirium, while from the assessment of nutritional status the patient was found to be at risk of malnutrition. She was in a state of mild cognitive impairment, not depressed and had no incontinence. She was at moderate risk for deep vein thrombosis using the Wells Score System. She had low risk on the Morse fall scale. She was in a pre-frail condition and there was no failure to thrive. Based on the Fracture Risk Assessment Tool (FRAX) score, there was a moderate risk of major osteoporosis. There was mild visual and hearing impairment, but no physical disability. The patient was placed in an isolation treatment room and given oxygen therapy, dietary nutrition at 1500 Kcal per day and 75 grams of protein per day, levofloxacin 1x750 mg intravenously for 7 days, remdesivir loading dose 1 x 200mg intravenously on day 1 and 1x100mg intravenously on days 2-5, dexamethasone 2x5mg intravenously, paracetamol 3x500 mg orally, omeprazole 2 x 40 mg intravenously, vitamin C 2x500 mg, insulin Aspart 3x4 units subcutaneously and insulin Glargine 14 units every 24 hours subcutaneously and enoxaparin subcutaneously 0.6 ml every 24 hours.

There were several post-treatment situations that significantly improved in terms of both general health and the findings of patient examinations, including physical examinations and laboratory tests, which also showed a satisfactory improvement. Additionally, the

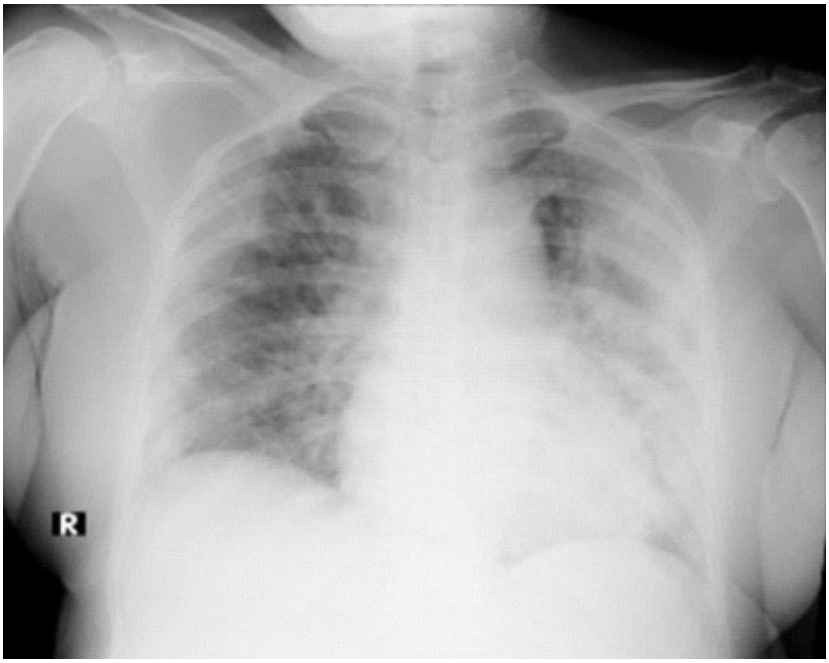

Figure 1. Thorax photo of the patient's chest when she was first admitted to the hospital

Table 1. Clinical laboratory findings of the patient

Test	Parameter	Values
Complete blood count	WBC (10^3/µL)	5.16
	Neu (10^3/µL)	4.42
	Lym (10^3/µL)	0.49
	Mono(10^3/µL)	0.23
	Eos (10^3/µL)	0.01
	Baso (10^3/µL)	0.01
	Hb (g/dL)	11.61
	Hct (%)	34.23
	MCV (fL)	83.93
	MCH (pg)	28.47
	MCHC (%)	31.29
	PLT (10^3/µL)	356.70
Blood chemistry	SGOT (U/L)	53.0
	SGPT (U/L)	30.0
	BUN (mg/dL)	25.90
	SC (mg/dL)	1.06
	e-GFR	124.04
	Albumin (g/dL)	3.30
	Blood glucose (mg/dL)	245
	HbA1c (%)	13.6
	Total Cholesterol (mg/dL)	178
	HDL (mg/dL)	37
	LDL (mg/dL)	116
	Triglycerides (mg/dL)	140
Electrolytes	K^+ (mmol/L)	4.10
	Na^+ (mmol/L)	131
Blood gas analysis	pH	7.41
	pCO_2	38.7
	pO_2	88.8
	Base excess (g/dL)	3.3
	$HCO3^-$	24.1
	SO_2 (%)	89
Real Time-PCR		**Reactive**

e-GFR: glomerular filtration rate; BUN, blood urea nitrogen; Hb: hemoglobin; Hct: hematocrit; HDL: high-density lipoprotein; LDL: low-density lipoprotein; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration; PLT: platelets; SC: serum creatinine; SGPT: serum glutamic pyruvic transaminase; SGOT: serum glutamic oxaloacetic transaminase; WBC: white blood cells

patient was monitored more closely while receiving care at home, and her condition improved. The patient was informed of the scientific and clinical interest in her disease as well as of this anonymous publication. She gave informed verbal consent to the anonymous publication.

DISCUSSION

According to a study, elderly people are more frequently affected by SARS-CoV-2 infection than are people of younger ages, and this association is more frequently negative.[7] Based on a retrospective analysis of 85 patients who had died in Wuhan from SARS-CoV-2 infection, the patients' median age was 65.8 years.[8] Numerous immune system biochemical changes brought on by aging are associated with age-related disorders and increased vulnerability to communicable diseases. Senescent immune cell accumulation contributes to the immune system's decline as it ages, while concurrently increasing inflammatory phenotypes lead to immunological dysfunction. These two processes are known as immunosenescence.[9]

Atypical symptoms found in elderly patients with COVID-19 are delirium, low-grade hyperpyrexia, and abdominal pain.[10] A consensus from The Infectious Disease Society of America recommends guidelines for the definition of fever in the elderly, namely the result of measuring an oral temperature of more than 37.8°C.[11]

The presence of DNA methyltransferase inhibition in Treg cells can accelerate the resolution of lung injury in younger persons, whereas in the elderly there is hypermethylation of Treg cell DNA due to mitochondrial dysfunction caused by the accumulation of toxic metabolites and reactive oxygen species in this population.[12] There are differences in ACE-II levels in lung tissue compared to the young population, which according to several studies showed a decrease in ACE-II expression in the elderly population.[10,13] ACE-II gene polymorphism was also found in exon 19 of chromosome Xp.22.2 in the elderly. One polymorphism that is known to increase mortality in the elderly with COVID-19 is the deletion of intron 16 in the ACE-II gene.[2] T cells play a role in the adaptive ability of immunity to increase antigen-specific memory T cells, which can predispose to the development of severe COVID-19 infection, increased length of hospitalization and the occurrence of acute respiratory distress syndrome (ARDS).[12]

The population shows a continuous production of inflammatory mediators and cytokines which is often known as inflammaging. Expression of Toll-like receptor (TLR) may increase but the function of the T cells decreases, so that the antigen presenting cell (APC) response in the face of viral infection becomes inappropriate which ultimately triggers excessive cytokine production.[10,14] Aging-related immunosenescence is associated with chronic secretion of pro-inflammatory cytokines known as senescence associated secretory phenotype (SASP). Accumulation of SASP cells during aging can lead to persistent withdrawal and activation of effector immune cells, which impairs local communication between pro- and anti-inflammatory systems, leading to tissue damage and incorrect tissue repair.[12]

The administration of chloroquine in the elderly must be very closely monitored regarding its lethal effects through increased QT interval and hypoglycemia. Administration of tocilizumab is contraindicated in the elderly with a history of diabetes, bacterial infection and the use of corticosteroids, to avoid superimposed infection.[10,15,16] Patients with complications of sepsis accompanied by a D dimer level of 3 g/mL and a coagulation score of >4 can be given anticoagulant therapy with direct oral anticoagulant (DOAC) to prevent thromboembolic events.[10]

In elderly patients infected with COVID-19, the inflammatory reaction produced on the surface of the lung epithelium makes it difficult to remove the bacteria so that secondary bacterial infections often occur and can worsen the prognosis.[1,3,16] Based on the National Institute for Health and Care Excellence (NICE) guidelines, the administration of antibiotics to the elderly over the age of 75 years with COVID-19 infection who have pneumonia due to secondary bacterial infection, should take place at least 4 hours after the onset of infection.[16]

The use of corticosteroids is controversial in viral infections due to their immunosuppressant effects.[17] In addition, it should be noted that the use of steroids in the elderly could have metabolic effects that could trigger comorbidities in the elderly such as hypertension, diabetes, bone fractures and cataracts.[10,18]

Nutrition plays an important role in the management of COVID-19 infection in the elderly, where good nutrition will help improve the immune system of the elderly.[19,20] Most of the elderly suffer from nutritional disorders, especially malnutrition. The caloric requirement in patients aged over 65 years with multiple comorbidities is 20 to 30 kcal/kgBW/day whereas the target of 30 kcal/kgBW/day should achieved slowly over 3 to 4 days to avoid the risk of refeeding syndrome. Protein needs in the elderly with COVID-19 infection should be higher due

to increased protein catabolism due to pro-inflammatory mediators where protein requirements are estimated to be 1g/kgBW/day – 1.5g/kgBW/day. The recommended ratio of fat to carbohydrates is 30:70 in patients without respiratory deficiency and 50:50 in patients who use ventilation.[20,21] Immunosenescence in elderly patients can be triggered by malnutrition.[14,20]

Micronutrient intake in the elderly infected with COVID-19 must exceed the recommended daily intake because infectious conditions can reduce the body's micronutrient levels. Micronutrients that must be considered include vitamin C which functions in increasing the immune system which is recommended to be consumed at 24g/day for 7 days. Zinc deficiency can increase the risk of infection, where studies examining the effects of zinc administration show that zinc supplementation can increase natural killer cell activity through increased expression of perforins.[22]

Our patient was observed to be in good health and to be devoid of COVID-19-related comorbidities and sequelae at the post-treatment check-up. Although complaints including weakness and occasionally dizziness still exist, they are more likely to be caused by the influence of multiple additional co-morbidities than because of COVID-19 directly. Elderly care at home has an important role in treating COVID-19 in the elderly. The related facilities must prepare several pharmacological therapies that can be used for the elderly experiencing COVID-19 infection. Mortality of the elderly with COVID-19 is higher in nursing home facilities than in hospitals so that service providers must be prepared about administering drugs that can help relieve suffering before death.[11] In the case of elderly living in isolation from daily activities without access to communication with their families, this can lead to a worsening of their perception of reality, changes in sleep patterns, and delirium. Service providers for the elderly must be ready with psychological support for their patients during this pandemic to minimize the incidence of depression in these elderly.[12]

CONCLUSION

Information on COVID-19 immunopathology is still limited and our understanding of the disease is evolving rapidly. Thus, the current evidence may soon change with the accumulation of new knowledge of SARS-CoV-2 biology and host immune responses. Assessment of geriatric status must be carried out comprehensively and the complexity of management in elderly patients infected with COVID-19 needs to be carefully considered.

CONFLICT OF INTEREST

The authors report no conflicts of interest in this work.

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AUTHOR CONTRIBUTIONS

IGPSA contributed to diagnosis and was responsible for the management of this patient. IAPP contributed to revision of the manuscript. Both authors contributed equally to the presentation of the case report. All authors have read and approved the final manuscript.

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