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Case Report

Improvement of Severe Maternal Covid-19 Outcome with the Use of EMCO (Extracorporeal Membrane Oxygenation) at Dr. Soetomo General Hospital Surabaya: Serial Case Study

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ABSTRACT

Indonesia, like many other nations, has been significantly impacted by the COVID-19 disease since its emergence in late 2019. The first COVID-19 case in Indonesia was reported in March 2020, affecting people of all ages, races, and backgrounds, including pregnant patients. Pregnancy has been recognized as a co-morbidity for COVID-19 by the CDC. Among the various issues observed in COVID-19 patients, respiratory complications have been prevalent, leading to the widespread use of oxygen support and respiratory assistance devices. Patients with severe respiratory problems due to COVID-19 often require ventilators, and in cases requiring long-term ventilator support, ECMO (extracorporeal membrane oxygenation) is employed. This serial case report presents three cases of severe maternal COVID-19 that necessitated treatment with both ventilators and ECMO. In the first case, the patient was diagnosed with severe COVID-19 at 35/36 weeks of gestation. The second case involved a patient diagnosed with mild COVID-19 at 30/31 weeks of gestation. The last case featured a patient with moderate COVID-19 at 35/36 weeks of gestation. All three patients received ECMO after the termination of their pregnancies. The maternal outcomes varied among the cases, with the third case reporting a poor outcome due to the severe complications such as pulmonary hypertension and septic shock. However, the other two patients experienced manageable complications and had favorable maternal outcomes. Given the severity of the disease, gestational age, and associated complications, the impact of COVID-19 on pregnancy is still a subject of ongoing investigation. Appropriate management strategies should be pursued to improve outcomes for both mother and fetus.

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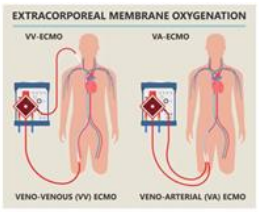
GRAPHICALABSTRACT



In this serial case report, we present three cases of severe maternal Covid-19 that required treatment with both ventilators and ECMO

- First case, the patient was diagnosed with severe Covid-19 at 35/36 weeks of gestation.
- Second case involved a patient diagnosed with mild Covid-19 at 30/31 weeks of gestation.
- Last case featured a patient with moderate Covid-19 at 35/36 weeks of gestation.

All the three patients received ECMO after their pregnancy was terminated.

The maternal outcome in the third case was reported poor. However, the other two patients had manageable complications and favorable maternal outcomes

Given the severity of the disease, gestational age, and associated complications, the impact of Covid-19 on pregnancy is still under investigation. In order to improve the outcomes for both the mother and the fetus, appropriate management strategies ought to be pursued.

Introduction

Indonesia reported its first case of COVID-19 infection in March 2020, marking the onset of the global pandemic at the end of 2019. As of July 2021, there have been 197 million confirmed cases of COVID-19 worldwide. During the same period, the Ministry of Health's data indicated that Indonesia had experienced 3.33 million cases [1]. The Centers for Disease Control and Prevention (CDC) identified various underlying medical conditions that could exacerbate the effects of COVID-19. These conditions include chronic lung disease, heart disease, diabetes, Down syndrome, HIV, autoimmune diseases, liver disease, obesity, pregnancy, thalassemia, and cerebrovascular disease [2]. Among these, pregnancy was highlighted as a condition requiring special attention in cases of COVID-19. In 2020, the Obstetrics Department at Dr. Soetomo Public Hospital confirmed 145 cases of COVID-19. By July 2021, the number of confirmed cases in obstetrics had risen to 203. It has been reported that most COVID-19 patients experience respiratory distress. In India, it was noted that 13.95% of 4,012 confirmed COVID-19 patients suffered from severe pneumonia. For some patients with severe COVID-19, ventilator support is necessary to manage respiratory failure [3, 4].

Case report

Case 1

Mrs. A is a 27-year-old woman who gave birth prematurely. She was referred from Hospital P on the sixth day post-cesarean section with confirmed severe COVID-19 pneumonia. At 35/36 weeks, the patient had a fever, a runny nose, and a cough, and the PCR swab test came back positive. Six days later, she complained of shortness of breath, and her oxygen saturation was 92%, leading to intubation. Subsequently, a cesarean section was performed, delivering a male fetus weighing 3,000 grams and measuring 50 cm, with Apgar scores of 7-8. On the sixth day post-cesarean section, the patient was referred due to prolonged ventilator requirement. On physical examination, the patient was sedated with a blood pressure of 139/90 mmHg, heart rate of 103 beats per minute, and temperature of 38.5 °C while on the ventilator on the seventh day.

Obstetric examination revealed normal uterine contractions, the fundal height at half the symphysis pubis, and no signs of excessive bleeding. Bilateral pneumonia was observed on a chest X-ray. SaO_2 was found to be 94% by arterial blood gas analysis, with a P/F ratio of 69. Veno-venous ECMO was started on the eighth day of ventilator use. Acinetobacter baumannii growth was found in the sputum, so the patient received 960 mg of cotrimoxazole intravenously every 12 hours for 17 days. After a urine culture revealed Candida glabrata, intravenous micafungin of 100 mg every 24 hours was administered for 21 days. On the eighteenth day of treatment, with a further developed condition, the patient was effectively extubated, and the Veno-venous ECMO was suspended. The use of oxygen support was gradually reduced as the pneumonia improved. The patient was discharged from the hospital after 45 days of treatment, having completed COVID-19 isolation with two negative swab tests.

Case 2

Mrs. D, a 32-year-old primigravida preterm, came to the hospital with a positive PCR test result and complaints of shortness of breath. The patient was conscious and had a blood pressure of 107/65 mmHg, a heart rate of 100 beats per minute, a respiratory rate of 22-24 breaths per minute, a temperature of 36.8 °C, and an oxygen saturation of 98% without the use of oxygen support during the physical examination. Obstetric examination revealed a fundal height of 23 centimeters, a cephalic presentation, a fetal heart rate of 145 beats per minute, and a single contraction that lasted 15 seconds over a period of ten minutes. A vaginal examination revealed a 1 cm cervical dilation. Ultrasound showed a live singleton fetus with a cephalic presentation, estimated fetal weight of 1,627 grams, placenta in the fundus, and an amniotic fluid index (AFI) of 14.22. Bilateral pneumonia was observed on a chest X-ray. Lung maturation and tocolytic therapy were given to the patient as part of a conservative treatment plan. During the treatment, the patient experienced worsening shortness of breath with an oxygen saturation of 90%. A non-rebreathing mask with oxygen support at 15 liters per minute and a P/F ratio of 60 were used. Due to maternal respiratory failure, termination of pregnancy was performed via cesarean section, resulting in the birth of a male infant weighing 1,800 grams, measuring 41 cm, with Apgar scores of 6-8. The postoperative condition of the patient showed a blood pressure of 91/58 mmHg, a heart rate of 91 beats per minute, a respiratory rate of 22-24 breaths per minute, a temperature of 36.7 °C, oxygen saturation of 97%, and a FiO_2 of 75% with a high-flow nasal cannula (HFNC) flowing at 35 liters per minute. On the fourth day post-cesarean section, the patient developed acute respiratory distress syndrome (ARDS) and required intubation. A hemodynamic decline with a blood pressure of 65/56 mmHg on the third day of ventilator use necessitated the administration of 75 nanograms of norepinephrine. Veno-venous ECMO was initiated simultaneously. Meropenem was given intravenously every 8 hours for seven days after a sputum culture revealed Acinetobacter baumannii. A urine culture showed Candida albicans, resulting in treatment with intravenous micafungin 100 mg every 24 hours for five days. With gradual improvement in respiratory and hemodynamic conditions, Veno-venous ECMO was discontinued after eight days of use. Two days later, the patient was successfully extubated. The patient was discharged from the hospital with self-isolation instructions after 25 days of treatment, with a positive PCR test result in the evaluation.

Case 3

Mrs. G, a 24-year-old multigravida preterm, presented to the hospital on her own with concerns about fluid leaking from her birth canal. Two days earlier, the patient had a fever and cough, and her PCR swab test came back positive. She was conscious and had a blood pressure of 101/56 mmHg, a heart rate of 110 beats per minute, a respiratory rate of 20 breaths per minute, a temperature of 36.8 °C, and an oxygen saturation of 98% while breathing through a nasal tube at a rate of 4 litres per minute during the physical examination. A positive litmus test, a fetal heart rate of 135 beats per minute, cephalic

presentation, fundal height of 26 cm, and no contractions were observed during the obstetric examination. Ultrasound revealed a live singleton fetus with a cephalic presentation, estimated fetal weight of 2,400 grams, placenta in the fundus, and an amniotic fluid index (AFI) of 4.5. A chest X-ray revealed bilateral pneumonia and partial atelectasis of the superior lobe. The patient underwent a cesarean section to end her pregnancy, resulting in the birth of a boy measuring 46 cm tall, weighing 2,200 grams, with Apgar scores of 7-9. The patient's condition deteriorated during treatment, resulting in respiratory failure on the fourth day of treatment with a P/F ratio of 183. Support was provided by a high-flow nasal cannula (HFNC) at 40 liters per minute and a FiO_2 of 60%. After being cultured for Acinetobacter baumannii, the patient received one gram of cefoperazone-sulbactam intravenously every 12 hours. The respiratory and hemodynamic conditions of the patient deteriorated on the 10th day of treatment, necessitating intubation and the administration of 75 nanograms of norepinephrine. With a leukocyte count of 50,030 and a procalcitonin level of 1.34 on the 13th day of treatment, the patient developed sepsis, necessitating the administration of 1 gram of meropenem intravenously every 8 hours. Echocardiography revealed myocarditis, a suspected pulmonary embolism, and dilatation of the right ventricle. Veno-arterial ECMO was started on the 15th day. Despite treatment for sepsis, multiple organ dysfunction syndrome (MODS) was observed. On the 21st day of hospitalization, the patient passed away.

Results and Discussion

COVID-19 is a global issue that affects the entire population, including obstetric patients. This study presented three cases of obstetric patients who required ECMO, each with different maternal outcomes. One patient experienced maternal death, while the other two were discharged in good condition. Two out of the three patients experienced worsening respiratory conditions after the termination of pregnancy, while one patient experienced respiratory failure during pregnancy (Table 1). Pregnancy itself is a comorbidity factor that can exacerbate the effects of COVID-19, and severe pneumonia can lead to maternal death in Covid-19 cases. In the first case, a favorable maternal outcome was achieved despite the patient's initial condition of severe pneumonia and comorbid obesity.

Table 1: Comparison of the outcomes of the COVID-19 cases with ECMO support

	Case 1 (Mrs. A)	Case 2 (Mrs. D)	Case 3 (Mrs. G)
Age (years)	27	32	24
Parity	Nulliparous	Nulliparous	Multiparous
Other Comorbidities	Extreme Obesity	(-)	(-)
Gestational Age	35/36 weeks	30/31 weeks	35/36 weeks
Initial Pneumonia Severity	Severe	Mild	Moderate
Ventilator Placement	During pregnancy	4 days postpartum	10 days postpartum
Duration of Ventilator Use before ECMO	8 days	3 days	5 days
Duration of EMCO Use	10 days	8 days	5 days
Complication	MRSA Wound Dehiscence	Septic	Septic Shock MODS Harlequin syndrome
Post-ECMO Care Maternal Outcome	15 days Good	9 days Good	6 hours Deceased
Perinatal Outcome	Good	Good	Good

This can be attributed to the early management of respiratory failure through the use of a ventilator. In addition, no other difficult-to-manage infections occurred during the patient's course. The perinatal outcome was good as the termination was performed during the late preterm stage with a fetus weighing more than 2,500 grams [5]. In the second case, a favorable maternal outcome was also achieved. Unlike the first case, the patient was initially diagnosed with mild COVID-19. However, the condition later worsened, and ventilator support was initiated on the fourth day postpartum due to respiratory deterioration [6]. The perinatal outcome was good in this patient due to the administration of lung maturation treatment and the appropriate timing of termination [7]. In the third case, the patient had moderate COVID-19 with a poor maternal outcome characterized by a gradual deterioration of the condition. The worsening of hemodynamic and respiratory conditions occurred simultaneously, and by the 10th day postpartum, the patient experienced respiratory failure and required intubation, with sepsis already developed. ECMO was also initiated in this patient due to the presence of myocarditis and suspicion of pulmonary embolism [8]. These factors likely contributed to the poor maternal outcome [9, 10]. This study has several limitations, including the limited use of ECMO tools due to the limited number and high price. Not all patients with ECMO indications can get this treatment right away due to limited equipment. Giving ECMO needs to be considered selectively so that there are not too many cases that need it.

Conclusion

COVID-19 is a novel disease that can affect individuals from all walks of life, including pregnant women. The Centres for Disease Control and Prevention (CDC) identifies pregnancy as a risk factor that can exacerbate the severity of COVID-19. However, many aspects of this disease remain unclear in the medical field. The prognosis of patients cannot be solely determined by the presence of comorbidities other than pregnancy. Therefore, the focus should be on preventing the spread of COVID-19 through vaccination, contact tracing, screening, and prompt treatment. Public education on these aspects is crucial to prevent further maternal deaths. As the number of severe COVID-19 cases requiring advanced oxygenation management, pruning, and PEEP administration increases, the use of ECMO in maternal Covid cases has become more common. ECMO is considered as the last resort due to its potential complications, such as bleeding, neurological damage, and heparin-induced thrombocytopenia [5, 10]. However, maternal Covid cases treated with ECMO have shown favourable outcomes based on the Regional Severe Disease Surveillance (RSDS) data.

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Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

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