Management of Critically Ill Pregnant Women With COVID-19

Roqhayyeh Asghari[1], Ata Mahmoodpoor[1] , Ali Akbar Ghamari[1]*

T he severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused a worldwide pandemic that is associated with high mortality in patients (1). Pregnant women are one of the susceptible groups to complications of the disease. Pregnancy causes hormonal and physiological changes in pregnant women that can predispose these patients to more severe complications from COVID-19. In the 12 months since the onset of the COVID-19 pandemic, approximately 16 pregnant patients have been admitted to our intensive care unit and treated. The diagnosis of COVID-19 for these patients has been made due to the positive result of the PCR test. Patients in case of exacerbation of complications caused by the disease and need for more care after counseling have been transferred to the intensive care unit and treatment has continued. Pregnant patients with COVID-19 are treated according to the latest national protocol and other valid international protocols. Pregnant patients are either transferred to the ICU during pregnancy or are admitted to the ICU after delivery due to worsening pulmonary symptoms and shortness of breath (2). Out of 16 pregnant patients admitted to the ICU, 14 patients were discharged from the ward in good general condition and 2 patients died due to the worsening of the disease. In this series of cases, we briefly described the 16 pregnant patients with COVID-19 who were admitted to the ICU due to the severity of the disease. Information about patients as well as the main treatments related to COVID-19 is given in Table 1.

Physiological and mechanical changes due to pregnancy predispose pregnant patients to infectious diseases. Hormonal changes caused by pregnancy cause immunosuppression in pregnant women (3). In addition, changes in the respiratory physiology of pregnant women make pregnant patients more susceptible to respiratory problems like difficult airway, pneumonia and ARDS which make airway assessment and management a critical part in dealing with these patients (4,5). The most common symptoms of COVID-19 in pregnant women include fever,

Ali Akbar Ghamari received his subspecialty in critical care medicine in 2019 from Tabriz University of Medical Sciences. During this period, he worked as an attending physician in Tabriz University of Medical sciences. Now, he works as an Assistant professor of Anesthesiology and Critical Care Medicine in department of Anesthesiology.

cough, shortness of breath, and lymphopenia. A meta-analysis showed that leukopenia was the most common paraclinical finding in pregnant patients with COVID-19 (66%). Other common laboratory findings include increased CRP, D-dimer, and LDH (6). The most common finding in CT scans of pregnant patients with COVID-19 is grand glass lesions and bilateral turbidity. The initial evaluation should be through the examination box using interphone. Medical history and a physical examination need to be evaluated followed by fetal heart rate auscultation, cardiotocography, or fetal ultrasound. Chest X-ray and laboratory testing are required for diagnosis and evaluating severity (7).

Differential diagnoses of COVID-19 in pregnant patients include pulmonary embolism, cardiomyopathy, pleural and pericardial effusion, preeclampsia, physiological dyspnea, and other bacterial and viral infections. In a meta-analysis of 637 pregnant patients with COVID-19, 3% of patients had a severe and critical illness that required intensive medical care with high morbidity, such as maternal and fetal death and preterm infant death (8). Other studies have indicated the mortality rate of pregnant women with COVID-19 being between 2 and 6 percent. The intensive care team has used the latest updated national and valid protocols at the time of hospitalization to treat critically pregnant patients with COVID-19. In order to monitor the condition of the fetus and the need to terminate the pregnancy, according to the conditions of the mother and the fetus, close cooperation has been made with the gynecology and obstetrics service. Of the 15 patients admitted to the ICU with a live fetus who terminated the pregnancy, only one infant died and the rest

Table 1. Characteristics of Patients in the Study

Patient number	Age	Gestational Age (wk)	Duration of Hospitalization in the ICU (Days)	Intubation & Mechanical Ventilation (days)	Treatments	PO$_2$/FiO$_2$ Ratio	APACHE Score	Outcome
1	33	29	14	4	HQ- Kaletra-Azith	60	9	Discharged
2	26	30	15	No	HQ- Kaletra -Azith-Methyl-Hemo	80	11	Discharged
3	32	31	5	No	HQ-Azith	56	13	Discharged
4	25	29	16	2	Rem-Methyl-Hemo	90	20	Discharged
5	23	1 week abortion	14	12	Rem-Methyl	35	22	Died
6	31	Post C/S	69	69	Rem-Methyl-Hemo	40	20	Discharged with tracheostomy
7	22	38	9	No	HQ-Kaletra-Azith-Methyl	41	10	Discharged
8	37	Post-partum	8	No	Rem-IVIG-Hemo	44	8	Discharged
9	29	34	14	10	Rem-Methyl	50	20	Died
10	24	36	16	11	Rem-Dexa	55	12	Discharged
11	15	32	10	5	Rem-Methyl	80	9	Discharged
12	26	34	12	8	Rem-Methyl	65	12	Discharged
13	32	34	17	13	Rem-Methyl	55	16	Discharged
14	26	36	7	No	Rem-Dexa	75	10	Discharged
15	33	38	6	NO	Rem-Dexa	65	14	Discharged
16	32	36	5	NO	Rem-Dexa	70	10	Discharged

Azith: Azithromycin, Dexa: Dexamethasone, Hemo: Hemoperfusion, HQ: Hydroxychloroquine Sulfate, Methyl: Methylprednisolone, Rem: Remdesivir.

of the infants were discharged in good general condition after a few days of intensive care in the hospital. ICU admission should be performed for pregnant women with abnormal hemodynamic status, shock or respiratory failure, abnormal inflammatory biomarkers, organ dysfunction, and high severity scores. Regarding the management of respiratory failure, if patients did not tolerate conventional O$_2$ therapy, we tried non-invasive ventilation through a full face mask or helmet and most of our patients tolerated these interventions. However, if they could not tolerate these and respiratory condition worsened, we performed intubation and mechanical ventilation with lung protective strategy. Mechanical ventilation was set up with the target of achieving higher maternal oxygen (target PaO$_2$ >70 mm Hg instead of 55–80 mm Hg) and lower carbon dioxide levels (target PaCO$_2$ 28–32 mm Hg) to maintain placental perfusion and prevent fetal hypoxemia and acidosis (9).

For stable pregnant patients with 28 weeks of gestation, the aim of management should be focused on supportive and antiviral treatments and gestation weeks should be prolonged as much as possible. For more than 28 weeks of gestation, fetal status should be closely monitored and corticosteroid should be used for maturation and pregnancy should be terminated especially if the maternal status worsens (10). The higher rate of mortality in our study can be due to two reasons: first, a possible shortage and burnout of healthcare providers and lack of intensive care resources, and secondly, Iran has a higher cesarean section rate than most other countries hit by COVID-19. Finally, it should be reminded that any pregnant woman with COVID-19 symptoms should be isolated and evaluated immediately. The time and mode of delivery must be chosen depending on the gestational period, condition of the fetus, and the mother's health status. A skilled multidisciplinary team comprised of intensive care specialists, neonatologists, obstetricians, and anesthetists should be available to evaluate and manage the risk of serious outcomes associated with COVID-19. The outcome of pregnant women with COVID-19 is negatively influenced by low levels of health infrastructure and low socioeconomics and knowledge level, especially in low- medium resources countries.

Ethical Issues
Not applicable.

Conflict of Interests
None.

Authors' contributions
AM and AAG: concept and design. AAG and R. data collection and interpretation of the data. AM and AAG: performing of the study and writing of the draft. All authors read and approved the study.

References
1. Mahmoodpoor A, Shadvar K, Ghamari AA, et al. Management of Critically Ill Patients with COVID-19: What We Learned and What We Do. Anesth Pain Med. 2020;10(3):e104900. doi: 10.5812/ aapm.104900
2. Nader ND, Mahmoodpoor A. COVID-associated respiratory distress syndrome (CARDS) in pregnancy; what makes it so different? Int J Womens Health Reprod Sci. 2020;8(4):336-337. doi:10.15296/ijwhr.2020.54
3. Ghabousian A, Mahmoodpoor A. Airway management in pregnant patients with COVID-19. Int J Womens Health Reprod Sci. 2020;9(1):1-2. doi:10.15296/ijwhr.2021.01
4. Mahmoodpoor A. Role for the second anesthesiologist in failed intubations. Anesth Analg. 2006;102(3):971. doi:10.1213/01.ANE.0000190879.76048.2D
5. Mahmoodpoor A, Peyrovifar A, Hamishehkar H, et al. Comparison of prophylactic effects of polyurethane cylindrical or tapered cuff and polyvinyl chloride cuff endotracheal tubes on ventilator-associated pneumonia. Acta Medica Iranica. 2013;51(7):461-466.

6. Wu D, Fang D, Wang R, Deng D, Liao S. Management of pregnancy during the COVID-19 pandemics. Global Challenges 2021;5:2000052. doi:10.1002/gch2.202000052

7. Lopez M, Gonce A, Meler E, et al. Coronavirus disease 2019 in pregnancy: a clinical management protocol and considerations for practice. Fetal Diagn Ther. 2020;47(7):519-528.

8. Turan O, Hakim A, Dashraath P, Jeslyn WJL, Wright A, Abdul-Kadir R. Clinical characteristics, prognostic factors, and maternal and neonatal outcomes of SARS-CoV-2 infection among hospitalized pregnant women: A systematic review. Int J Gynecol Obstet. 2020;151(1):7-16. doi: 10.1002/ijgo.13329

9. Dashraath P, Wong JLJ, Lim MXK, et al. Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. Am J Obstet Gynecol. 2020;222(6):521-531. doi: 10.1016/j.ajog.2020.03.021

10. Kurdoglu M, Khaki A. What is the current state of knowledge about the novel coronavirus infection during pregnancy? Int J Womens Health Reprod Sci. 2020;8(2):110-111. doi:10.15296/ijwhr.2020.17