



The Open Public Health Journal

Content list available at: <https://openpublichealthjournal.com>



RESEARCH ARTICLE

The Maternal Outcome of Patients with COVID-19 and their babies in the first 24 hours of Birth

Saeideh Salari¹, Rasoul Raesi^{2,3}, Niloofar Teimoori⁴, AbuBakr Jafarnejad⁵ and Salman Daneshi^{6,*} 

¹School of Medicine, Ayatollah Kashani Hospital, Jiroft University of Medical Sciences, Jiroft, Iran

²Mashhad University of Medical Sciences, Mashhad, Iran

³Department of Nursing, Torbat Jam Faculty of Medical Sciences, Torbat Jam, Iran

⁴Department of Medicine, School of Medicine, Jiroft University of Medical Sciences, Jiroft, Iran

⁵Research Committee of Shiraz University of Medical Sciences, Shiraz, Iran

⁶Department of Public Health, Jiroft University of Medical Sciences, Jiroft, Iran

Abstract:

Aim:

This study investigates the maternal outcome of patients with COVID-19 and their babies in the first 24 hours of birth in 2021 in Ayatollah Kashani Hospital, Jiroft.

Background:

The widespread spread of Covid-19 was accompanied by concern about vulnerable groups of society such as pregnant women and infants. This group of people in society is susceptible to this disease due to the weakening of the immune system.

Methods:

This cross-sectional study was conducted on 81 pregnant women with COVID-19 in 2021 in Ayatollah Kashani Jiroft Hospital. The data collection tool was adjusted according to the maternal and neonatal outcomes, and the inclusion criteria included pregnancy over 34 weeks confirmed by ultrasound and infection with COVID-19 confirmed by PCR test. Data were collected using a checklist and maternal and neonatal outcomes were reported. Data were analyzed with SPSS version 25 software and the significance level was ≤ 0.05 .

Results:

The prevalence of death in mothers with COVID-19 was 3.7%, in the present study, there was no higher rate of cesarean delivery, and 14.8% had premature delivery. The Apgar score of the examined infants at minute 0 was higher than 7, and infant death was not found, 18.5% were transferred to ICU and 29.6% had lung involvement.

Conclusion:

The results of this research showed that maternal complications, especially maternal death were more than expected but symptoms in infants did not significantly increase and infant death was not found in this study. However, it should be noted that the complications of COVID-19 in infants can be serious.

Keywords: COVID-19, Pregnancy, Infant complications, Hospitalization, Pregnancy, Babies.

Article History

Received: August 01, 2023

Revised: September 03, 2023

Accepted: September 11, 2023

1. INTRODUCTION

Human health has always been one of the most important issues of society, researchers are increasingly trying to provide solutions to improve health by using science and technology [1 - 3]. In this regard, viruses have been considered as one of the

viruses that can cause respiratory infections ranging from the common cold to more severe illnesses such as SARS and MERS [4, 5].

COVID-19 caused acute respiratory syndrome that was detected in Wuhan, China at the end of 2019, and quickly spread as a pandemic in different countries. The common symptoms include fever, headache, fatigue, muscle pain, and cough [6, 7]. In case of severe complications, it includes

* Address correspondence to this author at the Department of Public Health, School of Health, Jiroft University of Medical Sciences, Jiroft, Iran; E-mail: salmandaneshi008@gmail.com

respiratory, heart, and gastrointestinal problems [8 - 10].

The pandemic of COVID-19 around the world is also very worrying, and researchers and doctors are trying to find solutions to control and prevention [11]. The entry of COVID-19 into the world community has had wide consequences for the medical community, economy, and human society. This virus causes different symptoms in the human body, from mild to severe, and may even lead to death [12 - 14].

With the increasing prevalence of this disease, the incidence of COVID-19 in pregnant mothers is also increasing [15]. Therefore, the prevention and control of this disease in pregnant women and the potential risk of vertical transmission to the child have become a major concern [15, 16].

COVID-19 as one of the biggest health and medical challenges in the world, continues to have an impact on human society [17]. Pregnant women also have their concerns as one of the most vulnerable groups so it is necessary to carefully examine the benefits of interventions for the mother and the fetus in terms of possible risks [15, 17].

Some studies show that the impact of infection on pregnant women is not higher than others. Although in some cases, pregnant women may be more at risk due to the lack of an immune system, with strict adherence to health protocols, possible risks can be avoided [18, 19]. Pregnancy is one of the most important life stages for every woman, it is associated with significant physiological changes that make pregnant women more susceptible to infectious diseases than other people [20, 21].

Compared to the general population, pregnant women are more sensitive to respiratory diseases and have a low immune system. In addition, physiological changes during pregnancy cause hypoxia intolerance and decrease functional residual capacity and residual volume during pregnancy, so they are susceptible to infectious diseases and serious risks [22, 23]. Physiological changes during pregnancy reduce acute inflammatory immune responses to prevent fetal rejection, which makes pregnant women more vulnerable to severe illness after exposure to viruses, especially respiratory viruses [24 - 26].

Considering the possible risks, the necessary measures should be taken to protect the health of pregnant women and their fetuses and babies, especially during the epidemic of infectious diseases [26].

In a study, Nikpour *et al.* examined pregnancy outcomes and clinical manifestations of the disease of COVID-19 in pregnant women. Their results showed that the common manifestations of COVID-19 in pregnant women included fever, cough, and muscle pain. The most common laboratory results are a decrease in blood lymphocytes and an increase in blood CRP. Complications of pregnancy and childbirth in pregnant women included an increase in premature birth and an increase in the rate of cesarean section [27].

In research, Darvishi *et al.* investigated COVID-19 and pregnancy and showed that the most common clinical manifestations of patients are fever, cough, and muscle pain. In

the laboratory tests of these patients, lymphocytes and CRP increase and also increase the rate of premature birth and an increase in the rate of cesarean section [28].

Considering that during the outbreak of infectious diseases, pregnant women and their fetuses constitute a high-risk population and limited information is available about the effects of the COVID-19 disease on the mother and the baby. Moreover, the importance of the health of mothers and their babies at all times, especially in the special conditions of the COVID-19 pandemic. This study was conducted to investigate the impact of COVID-19 on pregnant mothers and their babies to help prevent hospitalization policies in this field with a better understanding of the disease and its consequences.

2. MATERIALS AND METHODS

This is a cross-sectional (descriptive-analytical) study that population study included all pregnant women infected with COVID-19 in one year. Data was collected using the checklist prepared by the researcher with studying the medical records of the patients. In this research, 81 pregnant women suffering from COVID-19 referred to Ayatollah Kashani Hospital in Jiroft in 2021 were examined. Data collection tools according to the expected outcomes of mothers including maternal mortality, the need to be transferred to the ICU and the need for early termination of pregnancy, and the outcome of babies including mortality after birth, Apgar scores at 0 and 5 minutes after birth, and the need to be transferred to NICU. The first part of the checklist form of demographic variables included demographic variables and the second part was information about epidemiological, clinical, laboratory, radiological, and treatment characteristics. The inclusion criteria included pregnancy confirmed by ultrasound, getting infected with COVID-19 confirmed PCR test, and pregnancy over 34 weeks.

After collecting information, the data were analyzed with SPSS-V25 statistical software. Quantitative data were reported as "standard deviation \pm mean" and qualitative data were reported as "number (percent)".

3. RESULTS

In this study, 81 pregnant women infected with COVID-19 were examined in 2021. The average age of patients was 29.16 ± 6.7 years. (Table 2) shows the information about mothers with COVID-19, out of 81 people examined, 6 people (7.3%) were in the age group of 15-20 years, and 34 people (42%) were in the age group of 20-30 years. 35 people (43.2%) were in the age group of 30-40 years and 6 people (7.3%) were in the age group of 40-50 years. 12 people (14.8%) gave birth by cesarean section and 69 people (85.2%) had birth naturally. 34 people (42%) were pregnant for the first time, 24 people (29.6%) were pregnant for the second time, 17 people (21%) were pregnant for the third time, 4 people (4.9%) were pregnant for the fourth time, and 2 people (2.5%) were pregnant for the fifth time. Out of 81 people examined, only 10 people (12.3%) were using drugs.

Table 2 shows the information related to the medical history of mothers with COVID-19, 6 people (7.4%) had heart disease, 5 people (6.2%) had hyperthyroidism, 1 person (1.2%) had Convulsions, 12 people (1.2%) had anemia, 2 people

(2.5%) had asthma and 4 people (4.9%) had pregnancy diabetes, as well as 8 people (9.9%) had blood pressure and 15 people (18.5%) were diagnosed with diabetes during pregnancy.

Table 1. Information about mothers with COVID-19.

Variables		Frequency	Percent (%)
Age	15-20	6	7.3
	20-30	34	42
	30-40	35	43.2
	40-50	6	7.3
Type of Delivery	Cesarean	12	14.8
	Normal	69	85.2
Pregnant	First time	34	42
	second time	24	29.6
	Third time	17	21
	Fourth time	4	4.9
	Fifth time	2	5.2
Drugs using	Yes	10	12.3
	No	71	87.7

Table 2. Determining the frequency of disease history in mothers with COVID-19.

Variables		Frequency	Percent (%)
Before pregnancy	Heart disease	6	7.4
	Hyperthyroid	5	6.2
	Convulsions	1	1.2
	Anemia	12	14.8
	Asthma	2	2.5
	Diabetes	4	4.9
During pregnancy	blood pressure	8	9.9
	Diabetes	15	18.5

Note: Out of 81 examined patients, 15 (18.5%) were transferred to ICU and 66 (81.5%) were not transferred to ICU.

Out of the 81 people examined, 14 babies (17.3%) were transferred to NICU and 67 babies (82.7%) were not transferred to NICU. The information about the mortality of mothers with COVID-19 transferred to the ICU shows that, out of 15 patients transferred to ICU, 3 people died and out of 81 people investigated, 78 people (96.3%) were alive.

Table 3. Determination of APGAR 0 and 5 in babies of mothers with COVID-19.

-	Variables	Frequency	Percent (%)
APGAR score	Minute 0	7	1.2
		8	6.2
		9	92.5
	Minute 5	10	100

Out of the 81 surveyed people, 12 people (8.14%) needed to terminate the pregnancy and 69 people (2.85%) completed the pregnancy completely.

It shows information about the Apgar score at minutes 0 and 5, at minute 0, 1 person (1.2%) had a score of 7, 5 people (6.2%) had a score of 8, and 75 people (92.5%) had a score of 9. Their APGAR score was 9. Furthermore, at the 5th minute, all the babies had an Apgar score of 10.

The information about the babies who needed oxygen therapy in the NICU shows that, of the 81 patients examined, 10 (3.12%) needed oxygen therapy and 71 (7.87%) did not need oxygen therapy. None of the patients had uterine atony. Also, 6 (7.4%) needed a vacuum and 75 (92.6%) did not need a vacuum.

Information about lung involvement in the CT scan of mothers with COVID-19 shows that, out of 81 people studied, 24 people (29.6%) had lung involvement and 57 people (70.4%) had no lung involvement. Moreover, 53 people (65.4%) had shortness of breath, and the rest did not have any symptoms of shortness of breath.

4. DISCUSSION

The aim of this study was to consider the maternal outcome of patients with COVID-19 and their babies in the first 24 hours of birth in 2021 at Ayatollah Kashani Hospital in Jiroft. In this study, 81 pregnant women were investigated. The prevalence of death in mothers with COVID-19 was found to be 3.7%, in some studies, maternal death due to COVID-19 was not reported, although severe symptoms were observed in 5% of cases [29]. In a study conducted in Shiraz, among 16 cases of mothers infected with COVID-19, one case of maternal death (6.25%) was observed [30]. Compared to the deaths of mothers in non-corona conditions that were reported in 2017, 0.76% occurred around the time of childbirth [24]. It should be noted that the prevalence of death due to COVID-19 in the general population has been reported at 3.4% [31]. which is somewhat consistent with the findings of the present study. Also, the results of studies on similar viral infections caused by the coronavirus, such as influenza and SARS in 2002 and Middle East respiratory syndrome in 2012, indicate an increase in the percentage of deaths and deaths in pregnant women and the appearance of fetal complications [7].

In the present study, there was no more cesarean section in these people, in the same way, in the study of Moia *et al.*, 2 babies were born by cesarean section [indication = 1 case of decollement and 1 case of non-progress of labor] and 5 babies were born naturally [25], contrary with the results of the present study in other countries, we can refer to Chen *et al.*'s study that all mothers underwent cesarean section [18], in Zhu *et al.*'s study, 7 women out of 9 women studied underwent cesarean section [22]. In a systematic review of Scoping Review, Al-Shafaei *et al.* showed that 33 studies were conducted on 385 pregnant women (369 with mild type, 14 with severe type, and 3 with critical condition) reported that 69.4% of the cases had been delivered by cesarean section, which could be caused by the fear of the treatment team for the natural delivery of these people [9].

14.8% of pregnant women infected with COVID-19 had a premature birth. Regarding preterm delivery, different numbers have been reported in other countries. For example, Mullins reported that 42% of mothers with COVID-19 had preterm delivery [32]. Chen *et al.* reported that 9 mothers in 2 weeks, week 36 pregnancies were delivered by cesarean section and [18], Zhu *et al.*, reported that 9.5% of women had preterm delivery [22]. Wang *et al.* reported that one woman had preterm delivery due to fetal distress [33]. Also, in the study of

Sarna *et al.*, it has been shown that infection with COVID-19 is associated with an increase in preterm delivery. The cause of preterm delivery in two recent studies is the use of retroviral drugs for mothers, which induce labor [34].

The Apgar score of the examined infants at minute 0 was higher than 7, and the death of the infant was not found. In this regard, in the study of Chen *et al.*, all babies had an Apgar score above 8 in 1 to 5 minutes after delivery, and none of the babies had neonatal asphyxia or death [18]. In a study by LIU *et al.*, they reported the results of their study about neonatal outcomes in China. The Apgar score was 8 or higher at minute 5 and no infant had asphyxia and no infant death was found [5]. The results of the study by YU *et al.* showed that out of 7 babies born to mothers infected with COVID-19, all were healthy with Apgar ≥ 9 , and none of them had infant asphyxia [23]. In Yang *et al.*'s study, in connection with 9 women with COVID-19 who were in their third trimester of pregnancy, no fetal death, infant death, or asphyxia was reported, and none of these cases occurred in four infants. It was not observed due to the COVID-19 infection. It is worth noting that the 5-minute Apgar score of all infants was 9 or more than 5 [35].

18.5% of women with COVID-19 were transferred to the ICU, in the study by Zaghim *et al.*, which was conducted on 108 pregnant women with COVID-19 infection, 91% of them had a cesarean section and 20% were in the intensive care unit. Mothers were hospitalized, but no maternal deaths were observed [36]. It was also reported in a study that about 30% of pregnant women were infected with SARS-COV-2, were hospitalized in the intensive care unit, and about 22% of them needed mechanical ventilation, and the death rate in these women was 25 percent [37].

Most pregnant women had shortness of breath. In pregnant women, due to the weakness of the immune system and physiological changes in the respiratory system [decrease in the height of the diaphragm, increase in oxygen consumption, edema of the mucous membrane of the respiratory tract], their tolerance to hypoxia decreases. Respiratory problems will increase in pregnant women infected with COVID-19 [38]. In Chen *et al.*'s study, the clinical symptoms are such that 44% experienced cough, and 33% experienced shortness of breath [18]. During pregnancy, lung volume, including functional residual capacity, expiratory volume, residual volume, and the total capacity of the lungs decreases with the enlargement of the uterus, in addition, pregnancy leads to an increase in oxygen consumption. Accordingly, pregnant women are susceptible to respiratory failure due to the infection caused by COVID-19 [38]. In a study, they also concluded that acute respiratory syndrome and Middle East respiratory syndrome during pregnancy cause severe complications such as the need for chip placement, ICU care, kidney failure, and death [7].

In the present study, 29.6% had lung involvement, which was obtained in different studies, this percentage was higher than in the present study, which may be due to geographical conditions and differences in sample size. Here we will refer to some of these studies, in a study they reported the results of radiographs of mothers infected with the coronavirus as follows, 88.8% of pregnant mothers had lung involvement, and 5 out of 9 infected pregnant mothers showed it in their lungs.

Double-sided frosted glass, 3 pregnant mothers' lungs contained a piece of solidification, but in one pregnant woman, no problems were observed and her lung was clean and without infusion [18]. Liu *et al.* used a 5-point scale to evaluate pulmonary involvement with CT scans. The classification of pulmonary involvement was as follows: 0: no involvement, 1: involvement less than 5%, 2: involvement less than 25%, 3: involvement between 25 and 49%, 4: involvement between 50 and 75%, and 5: more than 75 percent. In this study, 12 pregnant mothers were in Classification 4, 5 pregnant mothers were in Classification 3, and 4 were in Classification 2. The CT scan images obtained before and after delivery did not show any signs of aggravation of pneumonia after delivery [5]. In Zhu *et al.*'s study, before treatment, the CT scan of the pregnant women in the study showed typical changes in viral pneumonia, such as bilateral diffuse ground-glass opacities, stained lungs, and patchy margins. As the disease progressed, lung lesions increased, but after treatment, the lesions disappeared [23].

One of the advantages of this study is the research on the target group at risk and sensitive (pregnant women and babies), which are at greater risk of getting involved with COVID-19 and its complications. So until this study was done, there was not enough research in this field. Considering that pregnancy and childbirth may cause more risks for this group of patients, further study in this field can help us find better strategies to prevent and manage this disease in pregnant women and infants. Furthermore, research in this field can help doctors and specialists to be trained for better management and more effective treatment for this group of patients.

CONCLUSION AND RECOMMENDATIONS

This study showed that maternal complications, especially maternal death, were higher than expected in the study group, even considering the statistics of non-infected pregnant people. In other words, pregnant women with COVID-19 have a higher risk of death and maternal problems.

Regarding the results of neonatal symptoms, this research showed that there was no significant increase in the studied neonatal symptoms. Also, in this study death of the baby was not reported. However, it should be noted that the complications of COVID-19 in infants can also be serious, therefore more research on the complications of COVID-19 in pregnant women and infants will give us a better understanding of the risks and diseases associated with them and can help improve the health of this group of patients.

The most important strategy to prevent the infection and complications of COVID-19 in mothers and babies is to take preventive measures to prevent the infection of pregnant mothers and to minimize the possibility of infection of babies. Therefore, mothers and babies should be monitored according to the guidelines for the management of isolation before delivery, during delivery, and after delivery.

LIMITATIONS OF THE STUDY

One of the limitations of this study is the error percentage of the PCR test of COVID-19, which currently does not have a preferred method to reduce the error. Considering maternal and

newborn complications in pregnant women with COVID-19 seems that reducing the risk of infection in mothers and babies is one of the important ways to prevent these complications. Therefore, it is suggested that high-risk mothers and babies use pre-delivery, delivery, and post-delivery isolation guidelines. In addition, the need to conduct longitudinal studies with a larger sample size in Iran can be helpful.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the ethics committee of Jiroft University of Medical Sciences with the ethics code IR.JMU.REC.1401.014. The principle of confidentiality of information was done in data collection.

HUMAN AND ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. All human procedures followed were per the guidelines of the Helsinki Declaration of 1975.

CONSENT FOR PUBLICATION

In order to comply with ethical considerations in this research, the information of the participants was kept confidential and other people were not able to access this information. The names and surnames of the participants were not used for data collection, and data collection was done after obtaining the code of ethics from Jiroft University of Medical Sciences.

FUNDING

This study was funded by Jiroft University of Medical Sciences, Funder ID. 1200546, Awards/Grant number. 1200546.

STANDARDS OF REPORTING

STROBE guideline has been followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the Zenodo Repository, at <https://openpublichealthjournal.com/availability-of-data-materials.php>

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

The authors express their gratitude to all the staff of Ayatollah Kashani Jiroft Hospital and the participants in this study who cooperated patiently and sincerely.

REFERENCES

- [1] Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *Int J Antimicrob Agents* 2020; 55(3): 105924. [<http://dx.doi.org/10.1016/j.ijantimicag.2020.105924>] [PMID: 32081636]
- [2] Belokrinskaya TE, *et al.* Clinical course, maternal and perinatal outcomes of 2019 novel coronavirus infectious disease (COVID-19) in pregnant women in Siberia and Far East. *Obstet Gynecol* 2021; (2): 48-54. [<http://dx.doi.org/10.18565/aig.2021L2.48-54>]
- [3] Karimi-Zarchi M, Neamatzadeh H, Dastgheib SA, *et al.* Vertical transmission of coronavirus disease 19 (COVID-19) from infected pregnant mothers to neonates: A review. *Fetal Pediatr Pathol* 2020; 39(3): 246-50. [<http://dx.doi.org/10.1080/15513815.2020.1747120>] [PMID: 32238084]
- [4] Omer S, Ali S, Babar ZD. Preventive measures and management of COVID-19 in pregnancy. *Drugs Ther Perspect* 2020; 36(6): 246-9. [<http://dx.doi.org/10.1007/s40267-020-00725-x>] [PMID: 32292265]
- [5] Liu W, *et al.* Coronavirus disease 2019 (COVID-19) during pregnancy: A case series. *Preprints* 2020; 2020020373
- [6] Tong ZD, Tang A, Li KF, *et al.* Potential presymptomatic transmission of SARS-CoV-2, Zhejiang province, China, 2020. *Emerg Infect Dis* 2020; 26(5): 1052-4. [<http://dx.doi.org/10.3201/eid2605.200198>] [PMID: 32091386]
- [7] Jernigan JA, Low DE, Helfand RF. Combining clinical and epidemiologic features for early recognition of SARS. *Emerg Infect Dis* 2004; 10(2): 327-33. [<http://dx.doi.org/10.3201/eid1002.030741>] [PMID: 15030706]
- [8] Rezabeigi-Davarani E, Bokaie S, Mashayekhi V, *et al.* Epidemiological and clinical characteristics of COVID-19 patients studied by Jiroft University of Medical Sciences: Southeast of Iran. *J Adv Med Biomed* 2021; 29(136): 302-8. [<http://dx.doi.org/10.30699/jams.29.136.302>]. [<http://dx.doi.org/10.30699/jams.29.136.302>]
- [9] Mullins E, Evans D, Viner RM, O'Brien P, Morris E. Coronavirus in pregnancy and delivery: Rapid review. *Ultrasound Obstet Gynecol* 2020; 55(5): 586-92. [<http://dx.doi.org/10.1002/uog.22014>] [PMID: 32180292]
- [10] Shek CC, Ng PC, Fung GPG, *et al.* Infants born to mothers with severe acute respiratory syndrome. *Pediatrics* 2003; 112(4): e254-4. [<http://dx.doi.org/10.1542/peds.112.4.e254>] [PMID: 14523207]
- [11] Park MH, Kim HR, Choi DH, Sung JH, Kim JH. Emergency cesarean section in an epidemic of the middle east respiratory syndrome: A case report. *Korean J Anesthesiol* 2016; 69(3): 287-91. [<http://dx.doi.org/10.4097/kjae.2016.69.3.287>] [PMID: 27274377]
- [12] Wong SF, Chow KM, Leung TN, *et al.* Pregnancy and perinatal outcomes of women with severe acute respiratory syndrome. *Am J Obstet Gynecol* 2004; 191(1): 292-7. [<http://dx.doi.org/10.1016/j.ajog.2003.11.019>] [PMID: 15295381]
- [13] Rajewska A, Mikołajek-Bedner W, Lebdowicz-Knul J, Sokołowska M, Kwiatkowski S, Torb  A. COVID-19 and pregnancy – where are we now? A review. *J Perinat Med* 2020; 48(5): 428-34. [<http://dx.doi.org/10.1515/jpm-2020-0132>] [PMID: 32452195]
- [14] Poon LC, Yang H, Lee JCS, *et al.* ISUOG Interim Guidance on 2019 novel coronavirus infection during pregnancy and puerperium: Information for healthcare professionals. *Ultrasound Obstet Gynecol* 2020; 55(5): 700-8. [<http://dx.doi.org/10.1002/uog.22013>] [PMID: 32160345]
- [15] Assiri A, Abedi GR, Al Masri M, Bin Saeed A, Gerber SI, Watson JT. Middle East respiratory syndrome coronavirus infection during pregnancy: A report of 5 cases from Saudi Arabia. *Clin Infect Dis* 2016; 63(7): 951-3. [<http://dx.doi.org/10.1093/cid/ciw412>] [PMID: 27358348]
- [16] Abedi F, Minaei Moghadam S, Mafi MH. Coronavirus disease 2019 and pregnancy: A review study. *Navid No* 2020; 23(Suppl.): 43-50. [<http://sjiums.irshums.ac.ir/article-1-62-en.html>].
- [17] Rashidi Fakari F, Simbar M. Coronavirus pandemic and worries during pregnancy: A letter to editor. *Arch Acad Emerg Med* 2020; 8(1): e21. [PMID: 32185371]
- [18] Chelsea Elwood M, *et al.* SOGC committee opinion—COVID-19 in pregnancy. *J Obstet Gynaecol Can* 2020. [<http://dx.doi.org/10.1016/j.jogc.2020.03.012>]
- [19] Liu H, Wang LL, Zhao SJ, Kwak-Kim J, Mor G, Liao AH. Why are pregnant women susceptible to COVID-19? An immunological viewpoint. *J Reprod Immunol* 2020; 139: 103122. [<http://dx.doi.org/10.1016/j.jri.2020.103122>] [PMID: 32244166]
- [20] Chow EPF, Danielewski JA, Fehler G, *et al.* Human papillomavirus in young women with Chlamydia trachomatis infection 7 years after the Australian human papillomavirus vaccination programme: A cross-sectional study. *Lancet Infect Dis* 2015; 15(11): 1314-23.

- [http://dx.doi.org/10.1016/S1473-3099(15)00055-9] [PMID: 26201300]
- [21] Zhu N, Zhang D, Wang W, *et al.* A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020; 382(8): 727-33. [http://dx.doi.org/10.1056/NEJMoa2001017] [PMID: 31978945]
- [22] Yu N, Li W, Kang Q, *et al.* Clinical features and obstetric and neonatal outcomes of pregnant patients with COVID-19 in Wuhan, China: A retrospective, single-centre, descriptive study. *Lancet Infect Dis* 2020; 20(5): 559-64. [http://dx.doi.org/10.1016/S1473-3099(20)30176-6] [PMID: 32220284]
- [23] Azh N, *et al.* Evaluation of pregnancy outcomes in pregnant women with COVID-19 in Qazvin 1399. *Majallah-i Ipidimiyuluzhi-i Iran* 2021; 16(5): 10-9.
- [24] Moaya M, Shahali S, Farhoudi B. Maternal and neonatal outcomes of pregnant women with COVID-19 in Amir-al-momenin hospital during March to May 2020. *Majallah-i Zanan, Mamai va Nazai-i Iran* 2020; 23(9): 35-42.
- [25] Ebrahimi M, Sina S, Ghabimi M. Coronavirus disease 2019 (Covid-19), Perinatal And Neonatal Outcomes: A Systematic Review Study. *Nurs Midwifery J* 2021; 18(10): 785-94.
- [26] Nikpour M, *et al.* Pregnancy outcomes and clinical manifestations of COVID-19 in pregnant women: A narrative review. *J Mil Med* 2020; 22(2): 177-83. [http://dx.doi.org/10.30491/JMM.22.2.177]
- [27] Darvishi M, Shahali H, Amininafar M, Hajilou F. Covid 19 and pregnancy - A brief report. *Nurse and Physician within War* 2020; 8(27): 41-6. [http://dx.doi.org/10.29252/npwjm.8.27.41]
- [28] Rahimi F, Goli S. Coronavirus (19) in pregnancy and childbirth: A review study. *J Sabzevar Univ Med Sci* 2020; 27(4): 522-31.
- [29] Askary E, Tahereh P, Shiravani Z, *et al.* Coronavirus disease 2019 (COVID-19) manifestations during pregnancy in all three trimesters: A case series. *Int J Reprod Biomed* 2021; 19(2): 191-204. [http://dx.doi.org/10.18502/ijrm.v19i2.8477] [PMID: 33718763]
- [30] Riahy S. Covid-19 management in pregnancy, childbirth and postpartum. *Health Res J* 2020; 5(4): 257-67. [http://dx.doi.org/10.29252/hrjbaq.5.4.257]
- [31] Elshafeey F, Magdi R, Hindi N, *et al.* A systematic scoping review of COVID-19 during pregnancy and childbirth. *Int J Gynaecol Obstet* 2020; 150(1): 47-52. [http://dx.doi.org/10.1002/ijgo.13182] [PMID: 32330287]
- [32] Wang X, Zhou Z, Zhang J, Zhu F, Tang Y, Shen X. A case of 2019 novel coronavirus in a pregnant woman with preterm delivery. *Clin Infect Dis* 2020; 71(15): 844-6. [http://dx.doi.org/10.1093/cid/ciaa200] [PMID: 32119083]
- [33] Sarna D, Gupta D, Singla D. COVID19 and pregnancy-Two lives at risk. *J Anesth Crit Care* 2020; 12(4): 157-60.
- [34] Zaigham M, Andersson O. Maternal and perinatal outcomes with COVID-19: A systematic review of 108 pregnancies. *Acta Obstet Gynecol Scand* 2020; 99(7): 823-9. [http://dx.doi.org/10.1111/aogs.13867] [PMID: 32259279]
- [35] Yang H, Wang C, Poon LC. Novel coronavirus infection and pregnancy. *Ultrasound Obstet Gynecol* 2020; 55(4): 435-7. [http://dx.doi.org/10.1002/uog.22006] [PMID: 32134165]
- [36] Gillespie T. Coronavirus: Doctors fear pregnant women can pass on illness after newborn baby is diagnosed. 2020. Available From: <https://news.sky.com/story/coronavirus-doctors-fear-pregnant-women-can-pass-on-illness-after-newborn-baby-is-diagnosed-11926968>
- [37] Fan C, Lei D, Fang C, *et al.* Perinatal transmission of 2019 coronavirus Disease-Associated severe acute respiratory syndrome coronavirus 2: Should we worry? *Clin Infect Dis* 2021; 72(5): 862-4. [http://dx.doi.org/10.1093/cid/ciaa226] [PMID: 32182347]
- [38] Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72314 cases from the chinese center for disease control and prevention. *JAMA* 2020; 323(13): 1239-42. [http://dx.doi.org/10.1001/jama.2020.2648]

