Arch Obstet Gynecol. 2023;4(3):78-83.

Archives of Obstetrics and Gynaecology Research Article

The Effects of COVID-19 on Pregnancy Outcomes, as well as the Impact on Fetuses and Newborns: Cross-Sectional Study

Nasrin Soufizadeh[1], Farzaneh Hajizadeh[1,*], Fariba Seyedoshohadaei[1], Siroos Hemmatpour[2], Shamsi Zare[1], Ashkan Kamalzadeh[3]

[1]Department of Obstetrics and Gynecology, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran

[2]Department of Pediatrics, School of Medicine, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran

[3]Dentist, Private Dental Office, Shiraz, Iran

*Correspondence should be addressed to Farzaneh Hajizadeh, dr.farzaneh4020@gmail.com

Received date: August 07, 2023, **Accepted date:** September 12, 2023

Citation: Soufizadeh N, Hajizadeh F, Seyedoshohadaei F, Hemmatpour S, Zare S, Kamalzadeh A. The Effects of COVID-19 on Pregnancy Outcomes, as well as the Impact on Fetuses and Newborns: Cross-Sectional Study. Arch Obstet Gynecol. 2023;4(3):78-83.

Abstract

Background: Pregnant women, fetuses, and newborns are at a higher risk of exposure to infectious diseases during outbreaks compared to other populations.

Objectives: The purpose of this study is to investigate the effects of COVID-19 on pregnancy outcomes, as well as the impact on fetuses and newborns in Kurdistan, Iran. The study will cover the period from February 2020 to January 2021.

Methods: We conducted a study in Kurdistan province on 201 pregnant women who were infected with the COVID-19. We gathered relevant information from patients' files using a checklist. We used SPSS software version 21 to calculate the mean and standard deviation for quantitative variables and frequency and percentage for qualitative variables.

Results: The study found that patients had various symptoms including fever, cough, diarrhea, and more. 70% of mothers had fever and cough, while 54% had fever, cough, and myalgia. Positive results were found in CT and PCR tests. Some mothers were hospitalized in the ICU, and there were cases of maternal and infant deaths. Apgar scores were taken with most samples having scores of seven or above at one and five minutes after birth.

Conclusion: Pregnant women are unlikely to pass COVID-19 to their fetus during pregnancy or childbirth. If infected at the end of pregnancy, both mother and newborn seem to have appropriate health outcomes, but individual differences may occur. Pregnant women have the same risk of contracting COVID-19 as non-pregnant individuals.

Keywords: COVID-19, Pregnant mothers, Fetus, Infants

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, commonly known as COVID-19, is a respiratory illness that can be life-threatening. It is spreading quickly and poses a major public health concern worldwide [1-3]. On March 11, 2020, the World Health Organization declared the outbreak of pneumonia caused by the acute respiratory syndrome of the coronavirus (SARS-COVID) as a pandemic [4-9]. The virus belongs to the Nidovirales order and contains ribonucleic acid (RNA), which is isolated from the Coronaviridae family. It can cause mild respiratory and digestive tract infections, as well as severe cases such as viral pneumonia with systemic disorders. In the past, coronavirus

has caused SARS and Middle East respiratory syndrome (MERS) epidemics [10-13].

Pregnant women are more vulnerable to infectious diseases compared to the general population. They are especially at risk of respiratory diseases and severe pneumonia due to their low immune system. Furthermore, high levels of estrogen and progesterone cause swelling in their upper respiratory system, and the surface area of their lungs is limited. As a result, pregnant mothers are more susceptible to such illnesses [4,14]. It is particularly important to consider the impact of pregnancy on the cardiovascular and respiratory systems of mothers who have chronic diseases or congenital disorders [15]. These women may experience an increase in heart rate and cardiac output volume, as well as a rise in oxygen consumption. However, their lung capacity may decrease, and their immune system may adapt to tolerate the fetus as a differentiated antigen, which can increase their risk of infection [4,16]. It is important to note that pregnant mothers who contract infections may face severe complications, including the risk of cytokine storms, which could lead to death. This, along with other factors, makes pregnant women a vulnerable group. Additionally, during epidemics of infectious diseases, special attention should be given to newborns. Infected infants may not exhibit symptoms or may have mild to severe symptoms, including elevated but unstable body temperature, which is common in premature babies. While tachypnea, apnea, respiratory distress, tachypnea, vomiting, and feeding intolerance and cough are important indicators of infection in adults, they may not be specific signs of illness in infants [14,17,18].

This study aimed to explore the impact of COVID-19 on pregnancy outcomes and its effects on fetuses and infants in Iranian Kurdistan from February 2020 to January 2021.

Study Design

This cross-sectional study was conducted in Besat Sanandaj, Shahada Dehgolan, Sina Kamiyaran, Beheshti Qorveh, and Imam Khomeini Diwandara Kurdistan, Iran hospitals from February 2020 to January 2021. All female patients with laboratory-confirmed COVID-19 infection (positive in nasopharyngeal/throat swab specimens by reverse transcription polymerase chain reaction [RT-PCR]) or suggestive findings on high-resolution computed tomography (HRCT) of the chest were included. Suspected patients with similar symptoms were excluded from the study. The study investigated the relationship between exposure and outcome through a cross-sectional analysis. This period of time was from the past to the present, but the data of both sections were checked simultaneously. During the study, we were able to measure the prevalence of the outcome. This retrospective study was approved by the Ethics Committee of Kurdistan University of Medical Sciences (IR-MUK.REC.1400.284). The researchers ensured that the patients' information would remain confidential.

Characteristics of the studied community

The research focused on pregnant women during the COVID-19 pandemic, regardless of the presence of clinical signs and symptoms. The study's statistical sample included patients who met the inclusion criteria and did not meet the exclusion criteria.

Inclusion criteria

The inclusion criteria consisted of pregnant women with a positive RT-PCR test or a positive CT for COVID-19.

Exclusion criteria

Patients were excluded if we lacked access to their files after delivery.

Sample size

400 people were included in the study, and out of these 400 people, 201 people were included in the study due to positive CT scan and positive PCR.

Assessments

After gaining approval and coordinating with the relevant departments, hospitalized pregnant women with COVID-19 were examined. Laboratory tests, including white blood cells (WBC), C-reactive protein (CRP), and nasopharyngeal PCR tests, were conducted, and the need for intensive care unit (ICU), fetal ultrasound, type of delivery, weight of the baby, and maternal and fetal death statistics was recorded.

Statistical analysis

Data was analyzed using SPSS v21. Continuous variables were presented as ranges and categorical variables as percentages.

Results

According to the study, the mothers who participated had an average age of 30.27 ± 5.97 years. The babies' average weight was 646 ± 3170 grams, with an average gestational age of 27.69 weeks. Additionally, their average lymphocyte count was 22.54% as presented in **Table 1**.

The results of the study showed that 160 (79.6%) mothers had the highest frequency of fever, 182 (90.5%) had cough, 168 (83.6%) had acute cough and 6 (3%) had chronic cough, 13 (6.5 percent) diarrhea, 106 people (52.7 percent) shortness of breath, 30 people (14.9 percent) conjunctival hyperemia, 137 people (68.2 percent) chills, 141 people (70.1 percent) fatigue, 137 people (68.2%) had body pain (**Table 2**).

Table 1. Mean and standard deviation of quantitative variables in the studied samples.

	Number	Mean	Standard deviation	Minimum	Maximum
Age (years)	201	30.27	5.97	15	49
Baby's weight (grams)	184	3170	646	1000	4000
Gestational age (weeks)	196	27.69	9.16	17	40
Lymphocyte (percentage)	195	22.54	10.63	1	80

Table 2. Frequency distribution of clinical symptoms in studied patients.

Clinical symptoms		Abundance	Percentage
Fever	Yes	160	79.6
Cough	Yes	182	90.5
Type of cough	acute	6	3
	chronic	168	83.6
Diarrhea	Yes	13	6.5
Shortness of breath	Yes	106	52.7
Conjunctival hyperemia	Yes	30	14.9
Shivering	Yes	137	68.2
Tiredness	Yes	141	70.1
Body pain	Yes	137	68.2

Out of the mothers who were studied, 75 of them (37.3%) had a positive CT test result, while 172 (85.6%) had a positive PCR test result. Additionally, 3 (1.5%) of the samples that were studied showed positive RT-PCR results in newborns at birth (**Table 3**).

According to the study, out of 201 mothers, 16 (8%) were admitted to the ICU ward while 177 (88.1%) were admitted to the regular ward. Unfortunately, 4 (2%) of the hospitalized mothers died and 9 (4.5%) babies did not survive. Additionally, 44 (21.9%) mothers experienced premature birth while 3 (1.5%) babies had intrauterine infections (**Table 4**).

According to the study, only 6% of the samples had an Apgar score below 7, while 94% had a score of 7 or higher. All of the samples analyzed had a score of 7 or higher, as shown in **Table 5**.

Discussion

In the study of 201 patients, it was found that 37.2% of mothers had a positive CT test result and 85.6% had a positive PCR test result. The study found that patients had various symptoms including fever, cough, diarrhea, and more than 70% of mothers had fever and cough, while 54% had fever, cough, and myalgia. Of the hospitalized mothers, 2% died and 4.5% of infants died. Some mothers (8%) were hospitalized in the ICU, and there were cases of maternal (2%) and infant

Table 3. Frequency distribution of the results of para clinical tests in the studied patients.

Para clinical tests		Abundance	Percentage
CRP	Yes	147	73.1
CT test results	Positive	75	37.3
	negative	126	62.7
PCR test results	Positive	172	85.6
	negative	29	14.4
RT-PCR results of the newborn at birth	Positive	3	1.5
	negative	116	57.7

Table 4. Frequency distribution of maternal and fetal outcome in studied patients.			
		Abundance	**Percentage**
Mother's hospitalization in ICU	Yes	147	8
Death of mother	Yes	75	2
Death of a baby	Yes	126	4.5
Preterm delivery	Yes	172	21.9
Intrauterine infection of the fetus	Yes	29	1.5

Table 5. Apgar frequency distribution of one and five minutes in the studied samples.			
Apgar minutes one and five		**Abundance**	**Percentage**
Apgar minute one	Below 7	12	6
	7 and above 7	188	94
Apgar minute five	Below 7	0	0
	7 and above 7	200	100

(4.5%) deaths. Apgar scores were taken with most samples having scores of seven or above at one and five minutes after birth.

Yu et al. (2020) conducted a retrospective study on 70 pregnant mothers, whose average age was 32 years old. The study showed that 86% of patients had fever, while 14% had cough and shortness of breath. One infant was infected with COVID-19 36 hours after birth. Our study is similar to Yu et al.'s study, but the present study examined files of 201 patients, while their study examined 70. In their study, one infant had a fever and PCR positive, while in the present study, three infants had a fever and PCR positive. In both studies, lymphocytes were reduced. The study suggests that pregnant women are more susceptible to COVID-19 due to respiratory diseases and severe pneumonia. Pregnant women with chronic diseases or congenital complications are at higher risk. Clinical symptoms of pregnant women with COVID-19 include fever, cough, and shortness of breath, sore throat, lymphopenia, diarrhea, myalgia, weakness, and fatigue [19,20].

A study conducted by Chen et al. in 2020 sought to investigate the clinical characteristics of COVID-19 in pregnant women and the possibility of the virus being transmitted vertically to the fetus. The study retrospectively analyzed clinical records, laboratory results, and chest CT scans of 9 pregnant women who had COVID-19, as well as 19 laboratory-confirmed cases. The results showed that all nine pregnant patients underwent cesarean section during the third trimester, with seven of them exhibiting fever. Other symptoms included cough, myalgia, sore throat, and weakness. Fetal distress was observed in two cases, with five of the nine patients experiencing lymphopenia and three having elevated aminotransferase concentrations. However, none of the patients developed severe COVID-19 as of February 4, 2020, and 19 cases were either not infected or did not die. Nine live births were recorded, with no instances of infant asphyxia. Amniotic fluid samples, umbilical cord blood, infant throat swabs, and breast milk samples from six patients were tested for SARS-CoV-2, and all samples tested negative for the virus. In the study, all nine babies had a one-minute Apgar score of 8-9, while in the present study, 94% of the babies scored 7 or higher, with a five-minute Apgar score of 9-10. A total of 100 infants had an Apgar score of seven or higher. Lymphopenia was reported in five patients in the study, and the present study also reported the same condition [3,4].

A study by Schwartz et al. (2020) reviewed 38 cases of pregnant women with COVID-19 and their newborns to investigate the transmission of the virus from mother to fetus. The study found that, unlike SARS and MERS infections, COVID-19 did not result in maternal death in these cases. Although some women had comorbid conditions related to obstetrics, they did not lead to severe maternal COVID-19 disease. These conditions, including preeclampsia, gestational hypertension, uterine scarring, gestational diabetes, and uterine atony, did not appear to be risk factors for intrauterine transmission of COVID-19 to the fetus [21]. A systematic review by Zagham and Andersson (2020) in Sweden analyzed 108 cases of pregnant women with COVID-19. The average age of mothers at admission was 32 years, and common symptoms included fever, cough, and shortness of breath, diarrhea, fatigue, and body pain. Laboratory symptoms included lymphocytopenia, CRP, and positive COVID-19 test results. In their study, no cases of maternal death were reported, while in the present study, some cases were reported. The hospitalization rate in the ICU was also lower in their study. The studies showed some differences in the results regarding fetal death [22]. In comparing the two studies, it is worth noting that the research variables were almost the same, with pregnant

women confirmed to have COVID-19 by laboratory tests. The difference in results may be due to the number of samples examined, as the present study had a larger population under investigation.

A study conducted by Mehta et al. (2020) observed 9 pregnant women in their third trimester that had contracted COVID-19 and had undergone cesarean section. The patients were between 26 to 40 years old and did not have any chronic diseases, diabetes, heart disease, or hypertension. Out of the nine patients, seven had fever without chills, four had cough, three had body pains, two had a sore throat, two had lethargy, one had gastrointestinal symptoms, and one had shortness of breath. However, none of the patients required artificial respiration. Two patients suffered from a ruptured amniotic sac. All of them received oxygen therapy and antibiotics, while six patients were also given antiviral drugs. Results showed that six out of nine patients had lymphopenia, three had high alanine transaminase (ALT) and aspartate aminotransferase (AST), and seven had normal WBC. Eight out of nine patients had a chest scan that confirmed COVID-19 diagnosis. All nine babies were born healthy and had no respiratory complications, but two of them weighed less than 2500 grams. RT-PCR test results on amniotic fluid and umbilical cord blood of six patients were positive. The study compared the results to Mehta et al. (2020), which showed that the present study did not report any underlying diseases of mothers with COVID-19, while the previous study had clear information regarding the patients' underlying conditions. In both studies, lymphopenia was reported, but liver enzymes were only studied in Mehta et al. (2020) [23]. Most reported cases didn't show transmission of SARS-CoV-2 from mother to fetus [24]. Our study confirms rare but possible vertical transmission in utero.

Conclusion

The present study reported fever in 79.6% of patients, while the previous study did not report any fever. Although the disease symptoms were almost the same in both studies, their results were different. The previous study conducted RT-PCR on amniotic fluid and umbilical cord blood, while the present study did not. Based on the results of the study, it can be concluded that the clinical symptoms in pregnant mothers with COVID-19 were similar to most studies. The study reported cases of maternal and infant death, but it was not determined whether COVID-19 caused the deaths. The study showed that vertical intrauterine transmission was unlikely during natural childbirth, and pregnant women who contracted COVID-19 in their third trimester had appropriate outcomes for both mother and baby. There was also a difference between pregnant and non-pregnant women in contracting COVID-19.

Acknowledgments

The authors would like to thank Kurdistan University of Medical Sciences, Sanandaj, Iran for their assistance on this research (IR-MUK.REC.1400.284).

Conflict of Interest Statement

The authors declare that they have no competing interests.

Authors' Contributions

Nasrin Soufizadeh, Farzaneh Hajizadeh, Fariba Seyedoshohadaei, Siroos Hemmatpour, Shamsi Zare, Ashkan Kamalzadeh participated in the study design, methodological issues, analysis, interpretation of the study, and writing of article.

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