

# Pregnancy and COVID-19 Infection: A Study of 24 Cases

Shalaleh Aghaei<sup>1</sup>, MD;<sup>ORCID</sup> Roghayeh Mohammadirad<sup>2</sup>, MA; Azita Fathnezhad-Kazemi<sup>3\*</sup>, PhD<sup>ORCID</sup>

<sup>1</sup>Student Research Committee, Tabriz Medical Sciences, Islamic Azad University, Tabriz, Iran

<sup>2</sup>29 Bahman Hospital, Iranian social security organization, Tabriz, Iran

<sup>3</sup>Department of Midwifery, Women's Reproductive and Mental Health Research Center, Tabriz Medical Sciences, Islamic Azad University, Tabriz, Iran

\*Corresponding author: Azita Fathnezhad-Kazemi, PhD; Department of Midwifery, Women's Reproductive and Mental Health Research Center, Islamic Azad University, Tabriz Medical Sciences, Basmenj Road, Postal code: 51591-15705, Tabriz, Iran. Tel: +98 41 333271080; Email: afnkazemi@gmail.com

Received: September 09, 2022; Revised: October 15, 2022; Accepted: November 30, 2022

## Abstract

**Introduction:** There is scarce information about the effects of SARS-CoV-2 infection in pregnant women. The present study aimed to evaluate pregnancy's clinical characteristics and outcomes in women with COVID-19 and their babies.

**Case Presentation:** We conducted a case series study, from April 15 to May 30, 2021, including 24 cases with COVID-19 infection and their babies with a 30-day follow-up after delivery. The patients' mean (SD) age of was 31.50 (5.69) years, and all the deliveries were in the third trimester. Fever and myalgia were the most prevalent clinical symptoms in women. Positive RT-PCR test results [in 20 patients (83.33%)], and CT scan findings [in four patients (16.67%)] confirmed the diagnosis. Moreover, 66.66% of pregnant women with COVID-19 underwent Cesarean section. Performing a Cesarean section was mostly due to obstetric indications or the mother's request. None of the babies were positive PCR. Out of eight preterm infants, seven were admitted to the intensive care unit (NICU) for reasons other than COVID-19.

**Conclusion:** The most common obstetric outcomes were high rates of premature delivery and Cesarean section. Additionally, the most prevalent neonatal consequences were prematurity and low birth weight. There was; however, no evidence of intrauterine vertical transmission.

**Keywords:** Coronavirus disease, Gestation, Prenatal, Patient outcome, Baby

**How to Cite:** Aghaei S, Mohammadirad R, Fathnezhad-Kazemi A. Pregnancy and COVID-19 Infection: A Study of 24 Cases. Women. Health. Bull. 2023;10(1):67-76. doi: 10.30476/WHB.2023.97655.1215.

## 1. Introduction

The COVID-19 epidemic is a critical health crisis that emerged in China and is now affecting the whole world (1). Coronavirus disease leads to acute respiratory infection and other known and unknown complications (2). To date, the number of positive cases of COVID-19 has been increasing during the pandemic (3). Along with the surge of new cases, pregnant women are also increasingly infected with COVID-19 (4). The infection has caused serious concerns in pregnant women since similar viral infections, including SARS, MERS, and influenza have been reported to cause drastic complications in pregnancy. According to the reports in 2009, H1N1-related deaths in pregnant women were higher than that in the general population (5). It has also been reported that women are more vulnerable to adverse outcomes during pregnancy (using intubation, hospitalization in the ICU, and death in acute respiratory syndromes due to SARS and MERS) (6, 7). Furthermore, adverse obstetric events, such as premature delivery, abortion, intrauterine growth restriction of fetus, maternal death, and neonatal mortality have been

reported in coronavirus infections (7). Accordingly, COVID-19 can have great significance during pregnancy (8), especially considering the reports of suspected vertical transmission (9, 10). Although recent clinical reports have found no conclusive evidence of vertical transmission, further research should be conducted to rule out its possibility (11, 12). There are still several other unknowns about COVID-19 during pregnancy, such as clinical manifestations, disease severity, its impact on the delivery process, and neonatal outcomes. Given the importance of this issue, we studied the clinical characteristics and paraclinical findings of 24 patients hospitalized due to COVID-19 at the 29 Bahman Hospital in Tabriz, Iran. We also described pregnancy and childbirth outcomes of women with COVID-19 up to 30 days after delivery.

## 2. Case Presentation

In this case series, we retrospectively reviewed the clinical data of 24 pregnant mothers with confirmed COVID-19 from April 15, 2020, until May 30, 2021, who were admitted to 29 Bahman Hospital, Tabriz, Iran.

## 2.1. Data Collection

Through the patients' medical records, the required data, including past medical histories, clinical characteristics, and laboratory test results, imaging findings, treatment period and method, as well as pregnancy and childbirth outcomes were collected. The pregnant mothers with significant clinical symptoms, such as fever ( $\geq 37.8$ ), cough, gastrointestinal symptoms, fatigue, myalgia, and O<sub>2</sub> saturation  $\leq 93\%$ , along with laboratory findings, such as elevated concentrations of CRP ( $>10$  mg. L<sup>-1</sup>) or lymphopenia (lymphocyte  $<1100$ ) were considered as acutely suspicious for COVID-19. The criteria for COVID-19 diagnosis were based on Iran's Ministry of Health and Medical Education (MOHME) protocols (diagnostic therapeutic flowchart for COVID-19), which were first released on February 25, 2020, when the COVID-19 pandemic started. All the patients were diagnosed through positive reverse-transcription-polymerase-chain-reaction (RT-PCR) of throat swab samples and/or imaging findings in the chest CT scan, such as bilateral ground-glass opacification, patchy infiltrates, and pleural thickening. According to hospital policy, all the mothers with COVID-19 infection were followed up for 30 days following discharge.

A checklist with four sections was used for data collection:

1-Demographic and obstetric information: mother's age, gravid, parity, fetal age at admission, indication for hospital admission, type of delivery, pregnancy complications, and newborn gender.

2-Information related to COVID-19 disease: clinical symptoms, laboratory test results, radiographic findings, treatment, and the length of hospitalization.

3-Mothers and fetal consequences: miscarriage, preterm delivery, premature rupture of membranes (PROM), pre-eclampsia, vaginal bleeding, meconium-stained amniotic fluid, distress, intrauterine fetal death (IUFD), intrauterine growth restriction (IUGR), women's hospitalization and its duration.

4-Infant outcomes: COVID-19 infection, Apgar score, immaturity, low birth weight (LBW), infant death, newborn intensive care unit admission,

fever, and pneumonia.

## 2.2. Data Analysis

Data were described and presented as mean and standard deviation, frequency, and percentages using SPSS version 22.

## 3. Results

A total of 24 pregnant women diagnosed with COVID-19 were enrolling in this study. The average age of the mothers and fetal age were 31.50 years [SD (5.69), in the range of 19-42 years old] and 35.83 weeks (SD=3.62), respectively. Ten patients were hospitalized with the impression of COVID-19, and the other patients were admitted due to other reasons, like premature labor pain (n=2), labor pain (n=8), and PROM (n=2), IUGR (n=1), and history of Caesarean section (C-section) (n=1). COVID-19 was confirmed in all the pregnant women during the hospital stay. In terms of underlying diseases, seven patients had hypertension, one had cervical insufficiency with cervical cerclage, one had hypothyroidism and was under treatment with levothyroxine, two had major depressive disorder and were under treatment with antidepressants, and one had a history of mitral valve prolapses. The duration of hospitalization was between 2-17 days. Table 1 represents the details of demographic, obstetrics, and clinical characteristics of pregnant women.

### 3.1. Clinical Manifestations

The most common clinical symptoms included fever (n=15), myalgia (n=12), cough (n=11), shortness of breath (n=10), fatigue (n=9), sore throat (n=7), headache (n=5), and gastrointestinal symptoms (n=5). Decreased blood oxygen saturation (O<sub>2</sub> saturation  $<93\%$ ) was seen in six patients, and one patient had tachycardia.

### 3.2. Paraclinical Findings

Among the subjects, 13 had lung involvement which was revealed in high-resolution computed tomography (HRCT) without contrast. Moreover, among those with CT evidence of COVID-19 infection, four had negative RT-PCR results. In addition, positive results of nasopharynx and oropharynx specimens for COVID-19 RT-PCR were observed in 20 (83.33%) patients.

**Table 1:** Demographic, obstetrics, and clinical characteristics of pregnant women with COVID-19 disease

Case	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Demographics, obstetric characteristics																									
Age (year)	19	36	37	29	36	29	30	37	23	36	36	31	30	35	31	42	28	18	22	38	35	31	34	25	
Gravid	2	2	3	2	2	3	3	3	1	3	2	2	4	1	3	8	2	2	2	1	2	4	2	1	
Parity	0	1	1	1	1	1	2	0	0	2	1	1	2	0	1	4	1	1	1	0	1	0	1	0	
Ab	1	0	1	0	0	1	0	3	0	0	0	0	1	0	1	3	0	0	0	0	0	3	0	0	
GA ad-mission (weeks)	38	34	34	38	39	39	34	28	39	38	38	40	40	33	39	34	35	38	29	39	34	33	38	29	
Indication of admission	COV ID -19	COV ID -19	COV ID -19	COV ID -19	LP COVID-19 & Oligohydramnios	LP COVID-19 & Oligohydramnios	COV ID -19	IUGR & COVID-19	LP COVID	LP history of CS	LP history of CS	LP	LP	PROM	history of CS	his-tory of CS	PROM PLP	COV ID -19	COV ID -19	COV ID -19	COV ID -19	PROM v	PROM ID -19	COV ID -19	PLP
Underlying comorbidities	-	HBP	Cervical insufficiency	-	-	-	HBP	HBP	-	Hypothyroid	-	Con-vulsions & HBP	MPV	De-pres-sion	De-pres-sion	-	HBP	HBP	-	HBP	-	-	-	-	-
History of exposure to the disease	+	-	+	-	-	-	+	-	+	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	+
Length of stay in hospital (Total days)	6	5	4	10	5	5	3	10	4	3	5	3	3	3	2	10	17	3	3	10	3	4	4	4	4

Ab: Abortion; GA: Gestational Age, HBP: High Blood Pressure;MPV: mitral valve prolapses; LP: Labor Pain; PLP: Premature Labor Pain; PROM: Premature Rupture of Membranes; IUGR: Intrauterine Growth Restriction

**Table 2:** Paraclinical findings and treatment of pregnant women with COVID-19 disease

Case	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Para clinical findings																								
Lym- phocytes (%)	21.30	10.60	8.20	21.60	10.90	10.50	22.40	9.10	7.30	12.70	25.50	13.10	9.20	5.7	7.5	11.9	7.80	8.90	24.9	15.6	8.3	9.90	10.90	10.60
WBC	7000	9040	12000	6400	10000	10000	9300	10300	14900	8400	7800	8300	11100	18500	7700	14400	8800	9000	7600	6900	8400	11000	9500	8200
lym- pho- phe- nia	-	+	+	-	+	+	-	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+
Plt (×109/L)	202	184	279	110	151	257	122	217	229	208	126	186	174	281	184	203	156	180	145	148	180	106	124	230
CRP (>10 mg/L)	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+
PT (>14)	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	+
PTT (>40)	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	+
PCR	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+
CT evidence of pneumonia	-	-	+	+	+	+	+	-	+	-	+	-	+	-	-	-	+	-	+	+	+	-	-	+
Treatment																								
Oxygen therapy	-	-	-	+	-	+	-	+	-	-	+	-	-	-	-	-	+	+	+	+	-	-	-	-
Antiviral treatment	-	-	-	-	Ose- ta- mivir	Favip- iravir	-	-	-	-	-	-	-	-	-	-	Favi- pira- vir	-	-	Favi- pira- vir	-	-	-	Mer- ope- nem
Antibiotic	-	-	Azithro	Azithro	Azithro	Azi- thro	cef- triax- one	Azi- thro	-	Azi- thro	-	-	-	-	-	Azi- thro	Azi- thro	Azi- thro	Azi- thro	Azi- thro	Azi- thro	Azi- thro	-	Van- co- my- cin
Corticosteroids	-	+	+	-	-	-	+	+	-	-	+	-	-	+	-	-	+	-	+	-	+	+	-	+
Only supportive care	+	-	-	-	-	-	+	-	+	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-
Others	-	Mg so4	-	-	-	-	Mg so4	Mg so4	Hep- arin	-	-	-	-	-	-	-	-	-	hep- arin	-	-	-	-	hep- arin

CT: Computed Tomography, WBC: White Blood Cell, PLT: Platelet, CRP: C-reactive protein, PT: Prothrombin Time, PTT: Partial Thromboplastin Time; Azithro: Azithromycin

Positive RT-PCR results in 20 and CT findings in four patients confirmed the diagnosis. Furthermore, lymphocytopenia was found in 19 patients. However, leukocytosis (WBC  $11000-18500 \times 10^9/L$ ) was seen in six cases while high C-reactive protein (CRP) levels were seen in 21 pregnant mothers. Table 2 depicts the details of paraclinical findings and treatment of patients.

### 3.3. Treatment

Physicians administered both antiviral agents (oseltamivir and favipiravir) and antibiotics (vancomycin, ceftriaxone, meropenem, and azithromycin) for patients. To alleviate the symptoms, all the patients received supportive care, such as bed rest, hydration, oxygen therapy, and vitamin C, zinc, or selenium supplementation. Table 2 shows all the treatment approaches.

### 3.4. Maternal and Neonatal Outcomes

In total, 16 pregnancies (66.66%) were terminated with a C-section. Indications of C-section included a previous history of C-section (patient number 3, 7, 10, 15, 18, and 23), severe preeclampsia (patient number 2), maternal request (patient number 21), fetal distress/bradycardia after induction (patient number 4, 8, and 19), lack of labor progress (patient number 5 and 20), having previous colporrhaphy (patient number 16), and placenta abruption/bradycardia (patient number 17 and 22). The other eight patients had normal vaginal deliveries.

Based on the Fisher exact test, a comparison of CRP ( $P=0.249$ ) and While Blood Cell (WBC) levels ( $P=0.428$ ) between the two groups of C-section and Normal Vaginal Delivery (NVD) showed no statistically significant difference. Nevertheless, one of the patients (patient number 10) had a higher level of C-reactive protein (CRP) (7 vs. 9 mg/L) and WBC (8400 vs.  $14700 \times 10^9/L$ ) after the C-section.

Four patients needed admission to the ICU (patient number 8, 17, 19, and 20), out of whom, three had gestational hypertension (patient number 8, 17, and 20) and received methyldopa; their blood pressures were recorded at the time of admission were 154/90, 160/95, and 140/90 mmHg, respectively. In patient number 8 and 17, fetal growth restriction was diagnosed at 28 and 33 gestational weeks, respectively. Patient number 17, 19, and 20 had  $SPO_2$  of below 93% during hospitalization and all three

had signs of pneumonia in the CT scan (Figure 1).

Patient number 8 was a 37-year-old woman, G3P0, with two abortions, who was referred to the hospital with vomiting at week 29. In the initial physical examination, she had a fever ( $38.5^\circ C$ ), mild sore throat, and vomiting. Her blood pressure was 150/95 mmHg. Additionally, her lab tests showed lymphopenia and positive CRP. Her liver function tests were within the normal ranges and in urine test. 1+ proteinuria was also detected and her PCR test result was positive. She was under supportive care and received Betamethasone, Azithromycin, Magnesium Sulfate, as well as oxygen therapy due to fetal distress. After five days of monitoring, a C-section was done because of elevated blood pressure and bradycardia. She delivered a well-appearing male with Apgar scores of 3 and 7 at 1 and 5 minutes, respectively. Resuscitation measures were done and he was transferred to NICU immediately. However, she died because of respiratory problems and fetal growth restriction the day after delivery.

The mean (SD) weight and height of the neonates were 3075.25 (796.51) grams and 47.70 (4.08) centimeters, respectively. Among the newborns, there were eight cases of prematurity, terminated due to preeclampsia ( $n=3$ ), premature labor pain ( $n=2$ ), and PROM ( $n=3$ ). Furthermore, there were three cases of IUGR and two cases of meconium staining at 38 and 40 weeks of gestation (patient number 11 and 12, respectively). Seven patients admitted in NICU after birth. The results obtained from the mothers and neonates are shown in Table 3. Following up the mothers and their infants after 30 days of delivery showed no reported complications. Paraclinical findings found no evidence of COVID-19 in the infants.



Figure 1: The figure shows the radiography of patient number 20.

**Table 3:** Maternal and neonatal outcomes of pregnant women with Covid-19 Positive (n=18)

Case	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
<b>Maternal outcomes</b>																									
ICU admission	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	
GA delivery (weeks)	40	35	39	39	39	39	36	29	39	38	38	40	40	33	39	36	35	38	41	39	39	33	38	29	
Root of delivery	NVD	C/S	C/S	C/S	C/S	NVD	C/S	C/S	NVD	C/S	NVD	NVD	NVD	NVD	C/S	C/S	C/S	C/S	C/S	C/S	C/S	C/S	C/S	C/S	NVD
Cause leading to Cesarean	-	Severe pre-eclampsia	Pre-vit history of c/s	Fetal distress/bradycardia	Lack of labor progress	-	Pre-vit history of c/s	Pre-vit history of c/s	Fetal distress/bradycardia	Pre-vit history of c/s	Pre-vit history of c/s	-	-	-	Pre-vit history of c/s	Having colporrhaphy	Placenta abruptio/bradycardia	Pre-vit history of c/s	Fetal distress/bradycardia	Lack of labor progress	Elective labor	Placenta abruptio/bradycardia	Pre-vit history of c/s	-	
Gestational hypertension	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	
PPROM	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	
Preterm labor	-	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	
Placental abruption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	
<b>Neonatal outcomes</b>																									
Neonatal Sex	Female	Male	Male	Female	Female	Female	Male	Male	Male	Female	Male	Male	Female	Female	Female	Female	Female	Female	Male	Male	Male	Female	Male	Male	Female
Infant death	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weight	3750	2860	4400	3600	3700	2980	2600	1450	2995	3400	3441	3600	3450	2090	2880	2750	1670	3000	3840	4000	3150	2600	3000	1700	
Height	52	45	49	50	52	49	44	40	46	51	51	52	51	40	48	47	41	51	51	51	50	43	49	41	
Prematurity	-	+	-	-	-	-	+	+	-	-	-	-	-	+	-	+	+	-	-	-	-	+	-	+	
Apgar score <7	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-	-	+	+	+	-	-	+	-	+	
Dyspnea	-	+	-	+	-	-	-	+	-	-	-	+	+	+	-	+	+	+	+	-	-	+	-	+	
IUGR	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	+	+	-	-	-	-	-	+	
NICU admission	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-	-	+	+	+	-	-	+	-	+	

ICU: Intensive Care Unit, GA: Gestational Age, C/S: Cesarean Section, NVD: Normal Vaginal Delivery, PPROM: Preterm Premature Rupture of Membranes, IUGR: Intrauterine Growth Restriction, NICU: Neonatal Intensive Care Unit

#### 4. Discussion

Considering the past experiences with influenza, SARS, and MERS pandemics, we expect serious complications for infected individuals, especially pregnant women and their fetuses (13, 14). Needless to say, the impact of SARS-CoV-2 infections during pregnancy is still being investigated. Pregnancy with its fluctuating hormone level, lowered lung volume, and immunocompromised status may additionally predispose patients to a greater deteriorating clinical course (15). A previous paper reported that if virus infection causes lung injury in pregnant women, the incidence of respiratory distress will increase, especially in the second and third trimesters. Once respiratory failure occurs in mothers, hypoxemia can lead to fetal distress, abortion, premature delivery, and other adverse events (16).

Our retrospectively collected data included 24 patients infected with COVID-19 in their third trimester. In terms of clinical symptoms, our findings are in line with most previous reports, suggesting fever, myalgia, and cough as the most frequent symptoms at admission (17-20). In our study, only one patient (4.1%) experienced uncommon symptoms while in a study by Yan and colleagues, 23.3% of pregnant women were asymptomatic (21).

CT scan and RT-PCR tests are accurate and reliable tests for COVID-19 diagnosis; however, negative test results may be unable to rule out the infection. In our study, 20 (83.33%) of the total 24 pregnant women with COVID-19 had PCR-confirmed SARS-CoV-2 infection, and four (16.66%) had positive imaging findings. These results are in line with those reported by Abedzadeh-Kalahroudi and co-workers (22).

Despite comorbidities in some of the patients (n=20), there were no life-threatening mother SARS-CoV-2 diseases. These comorbidities included high blood pressure, major depressive disorder, seizure, hypothyroidism, cervical insufficiency, and mitral valve prolapse. Of 20 patients, seven pregnant women had high blood pressure, which was the most common comorbid condition. As mentioned in other studies, chronic diseases can increase the risk of COVID-19 disease and affect disease severity as well as its complications (23-25).

Our findings revealed that 79.2% of the women had lymphopenia in laboratory tests, which is consistent with other papers (26, 27). Nonetheless, the decrease in lymphocytes varied greatly from 44% up to 56% in different studies (17, 20). Furthermore, there was a rise in CRP levels in most patients (87.5%) although three of them (12.5%) showed no increase in CRP levels. In the study by Askary and co-workers and Yu and colleagues, CRP levels increased in all the patients (26, 27). Yan and colleagues found that only 44% of the patients had elevated CRP levels (21).

In this study, 62.5% of the patients received antibiotics. Meanwhile, in a study by Askary and colleagues (26) and Chen and colleagues, (17) 83% and 100% of patients received antibiotics, respectively. Moreover, 67% were treated with antiviral drugs. Yan and co-workers reported that almost all of the patients (94%) received antibiotics (21). These differences can be due to diversities in the treatment protocols of medical centers or unique conditions of the patients. Among all the patients of the third trimester, most patients had mild manifestations; however, four of them were in chronic conditions and needed hospitalization in the intensive care unit.

In this research, three mothers experienced a severe form of the disease (18.75%) and were admitted to the intensive care unit (ICU). In a study by Yan and co-workers, the rate of ICU admission was 6.2% and two patients underwent mechanical ventilation (21). Contrary to current findings, there was no case of ICU admission in the study of Yu and co-workers (27).

In the present study, 66.66% of the mothers underwent C-sections. Consistent with this result, the rate of C-sections was 77% in a study by Zhu and colleagues and 62% in a study by Abedzadeh-Kalahroudi and colleagues (20, 22). Nevertheless, the rate of C-sections was higher in other studies such as the papers by Chen and co-workers (100%) (17), Liu and colleagues (90%) (18), Yu and colleagues (91%) (27), and Yan and co-workers (89.5%) (21). In the study by Yan and colleagues, COVID-19 pneumonia led to C-sections in 38.8% of the cases (21) while the study indications of C-sections were all associated with obstetric conditions, which is consistent with the study of Abedzadeh-Kalahroudi and co-workers (22).

It is noteworthy that the early onset of labor pains and pregnancy termination can be related to the stress caused by the pandemic. Maternal and fetal conditions, the patients' decisions, and the obstetricians' opinions should be considered in making the final decision for either a C-section or a normal vaginal delivery. It has been reported that comorbid maternal conditions, like preeclampsia, hypertension, and diabetes, were not risk factors for intrauterine transmission of SARS-CoV-2 to the fetus (22, 26). Our study had no severe pneumonia or maternal deaths, similar to previous studies (22, 26, 28).

In terms of neonatal outcomes, there is a relatively higher rate of prematurity, ranging from 36.4% as reported by Liu and colleagues (18), and 44.4% as stated by Chen and co-workers (17) to 60% in the study by Zhu and colleagues (20) and 75% in the study by Askary and co-workers (26). In the present work, eight neonates (33.3%) were born prematurely. We found that 12.5% of the infants weighed less than 2500 grams (LBW). In a clinical analysis by Zhu and colleagues (20), it was found that 60% of infants were born premature, and in a study by Abedzadeh-Kalahroudi and colleagues, prematurity (38%) was the most prevalent neonatal outcome (22).

In this research, an Apgar score of below 7 was seen in seven (29.16%) neonates, and there was a case of neonatal death. As opposed to this finding, there were studies with no cases of asphyxia or death and an Apgar score of below 7 (17, 18, 27). However, other studies have reported cases of infant death because of fetal distress (20, 21). Of note, the deceased infant was not found to have COVID-19 and the cause of death was reported to be fetal growth restriction.

Furthermore, the NICU admission rate in the present study was 29.16%, which was lower than that in by Yan and colleagues in China (21). Differences in these findings may be attributed to disease severity, diagnostic and treatment methods, and individual differences.

#### 4.1. Limitation

One of the limitations of the study was the inability of case studies to express the cause-and-effect association. Another limitation was the method of information collection from patients'

records, which can lead to information bias. However, the information was controlled as far as possible by contacting the patients.

## 5. Conclusion

Our findings showed that symptoms and signs of COVID-19 during pregnancy developed to be analogous to the general population. The most usual clinical symptoms included fever, myalgia, and cough. In addition, the most common obstetric consequences were the increased rates of preterm delivery and C-section. The most prevalent fatal outcomes were prematurity and LBW. However, there was no evidence of intrauterine transmission. Information in hand about other respiratory infections proposes that pregnant women could have severe clinical courses. Case series studies can provide useful data for disease management in pregnant women. It is crucial to be vigilant about the spread of the disease and provide the rapid implementation of outbreak control measures.

## Acknowledgement

We would like to thank all patients, staff, and the head of Tabriz 29 Bahman Hospital., Tabriz, Iran.

## Ethical Approval

This study was approved by the ethics committee of the Islamic Azad university of Medical Sciences Tabriz Branch with the code of ethics IR.IAU.TABRIZ.REC.1399.121. Given that the data were extracted from patients' records, we didn't obtain the patient's consent.

**Conflict of Interest:** None declared.

## References

1. Cheng MP, Papenburg J, Desjardins M, Kanjilal S, Quach C, Libman M, et al. Diagnostic testing for severe acute respiratory syndrome-related coronavirus 2: a narrative review. *Ann Intern Med.* 2020;172(11):726-734. doi: 10.7326/M20-1301. PubMed PMID: 32282894; PubMed Central PMCID: PMC7170415.
2. Gorbalenya AE, Baker SC, Baric R, Groot RJD, Drosten C, Gulyaeva AA, et al. Severe acute respiratory syndrome-related coronavirus: The species and its viruses—a statement of



- the Coronavirus Study Group. 2020. doi: 10.1101/2020.02.07.937862.
3. Masjoudi M, Aslani A, Seifi M, Khazaeian S, Fathnezhad-Kazemi A. Association between perceived stress, fear and anxiety of COVID 19 with self-care in pregnant women: a cross-sectional study. *Psychol Health Med.* 2022;27(2):289-300. doi: 10.1080/13548506.2021.1894344. PubMed PMID: 33632035.
  4. Naccasha N, Gervasi M-T, Chaiworapongsa T, Berman S, Yoon BH, Maymon E, et al. Phenotypic and metabolic characteristics of monocytes and granulocytes in normal pregnancy and maternal infection. *Am J Obstet Gynecol.* 2001;185(5):1118-23. doi: 10.1067/mob.2001.117682. PubMed PMID: 11717644.
  5. Schwartz DA, Graham AL. Potential maternal and infant outcomes from (Wuhan) coronavirus 2019-nCoV infecting pregnant women: lessons from SARS, MERS, and other human coronavirus infections. *Viruses.* 2020;12(2):194. doi: 10.3390/v12020194. PubMed PMID: 32050635; PubMed Central PMCID: PMC7077337.
  6. Ksiazek TG, Erdman D, Goldsmith CS, Zaki SR, Peret T, Emery S, et al. A novel coronavirus associated with severe acute respiratory syndrome. *N Engl J Med.* 2003;348(20):1953-66. doi: 10.1056/NEJMoa030781. PubMed PMID: 12690092.
  7. Rasmussen SA, Jamieson DJ, Uyeki TM. Effects of influenza on pregnant women and infants. *Am J Obstet Gynecol.* 2012;207(3 Suppl):S3-8. doi: 10.1016/j.ajog.2012.06.068. PubMed PMID: 22920056.
  8. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA.* 2020;323(11):1061-1069. doi: 10.1001/jama.2020.1585. PubMed PMID: 32031570; PubMed Central PMCID: PMC7042881.
  9. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet.* 2020;395(10223):497-506. doi: 10.1016/S0140-6736(20)30183-5. PubMed PMID: 31986264; PubMed Central PMCID: PMC7159299.
  10. Nikpour M, Behmanesh F, Darzipoor M, Zavareh MSH. Pregnancy outcomes and clinical manifestations of Covid-19 in pregnant women: a narrative review. *J Mil Med.* 2020;22(2):177-183. doi: 10.30491/JMM.22.2.177. Persian.
  11. Alzamora MC, Paredes T, Caceres D, Webb CM, Valdez LM, La Rosa M. Severe COVID-19 during pregnancy and possible vertical transmission. *Am J Perinatol.* 2020;37(8):861-865. doi: 10.1055/s-0040-1710050. PubMed PMID: 32305046; PubMed Central PMCID: PMC7356080.
  12. Schnettler WT, Al Ahwel Y, Suhag A. Severe acute respiratory distress syndrome in coronavirus disease 2019-infected pregnancy: obstetric and intensive care considerations. *Am J Obstet Gynecol MFM.* 2020;2(3):100120. doi: 10.1016/j.ajogmf.2020.100120. PubMed PMID: 32363337; PubMed Central PMCID: PMC7194528.
  13. Zhou P, Yang X-L, Wang X-G, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature.* 2020;579(7798):270-273. doi: 10.1038/s41586-020-2012-7. PubMed PMID: 32015507; PubMed Central PMCID: PMC7095418.
  14. Hoffmann M, Kleine-Weber H, Schroeder S, Krüger N, Herrler T, Erichsen S, et al. SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor. *Cell.* 2020;181(2):271-280. doi: 10.1016/j.cell.2020.02.052. PubMed PMID: 32142651; PubMed Central PMCID: PMC7102627.
  15. Dang D, Wang L, Zhang C, Li Z, Wu H. Potential effects of SARS-CoV-2 infection during pregnancy on fetuses and newborns are worthy of attention. *J Obstet Gynaecol Res.* 2020;46(10):1951-1957. doi: 10.1111/jog.14406. PubMed PMID: 32779309; PubMed Central PMCID: PMC7436741.
  16. Chen S, Huang B, Luo D, Li X, Yang F, Zhao Y, et al. Pregnancy with new coronavirus infection: clinical characteristics and placental pathological analysis of three cases. *Zhonghua Bing Li Xue Za Zhi.* 2020;49(5):418-423. doi: 10.3760/cma.j.cn112151-20200225-00138. PubMed PMID: 32114744. Chinese.
  17. Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *Lancet.* 2020;395(10226):809-815. doi: 10.1016/S0140-

- 6736(20)30360-3. PubMed PMID: 32151335; PubMed Central PMCID: PMC7159281.
18. Liu W, Wang J, Li W, Zhou Z, Liu S, Rong Z. Clinical characteristics of 19 neonates born to mothers with COVID-19. *Front Med.* 2020;14(2):193-198. doi: 10.1007/s11684-020-0772-y. PubMed PMID: 32285380; PubMed Central PMCID: PMC7152620.
  19. Zhang L, Jiang Y, Wei M, Cheng B, Zhou X, Li J, et al. Analysis of the pregnancy outcomes in pregnant women with COVID-19 in Hubei Province. *Zhonghua Fu Chan Ke Za Zhi.* 2020;55(3):166-171. doi: 10.3760/cma.j.cn112141-20200218-00111. PubMed PMID: 32145714.
  20. Zhu H, Wang L, Fang C, Peng S, Zhang L, Chang G, et al. Clinical analysis of 10 neonates born to mothers with 2019-nCoV pneumonia. *Transl Pediatr.* 2020;9(1):51-60. doi: 10.21037/tp.2020.02.06. PubMed PMID: 32154135; PubMed Central PMCID: PMC7036645.
  21. Yan J, Guo J, Fan C, Juan J, Yu X, Li J, et al. Coronavirus disease 2019 in pregnant women: a report based on 116 cases. *Am J Obstet Gynecol.* 2020;223(1):111. doi: 10.1016/j.ajog.2020.04.014. PubMed PMID: 32335053; PubMed Central PMCID: PMC7177142.
  22. Abedzadeh-Kalahroudi M, Sehat M, Vahedpour Z, Talebian P, Haghghi A. Clinical and obstetric characteristics of pregnant women with Covid-19: A case series study on 26 patients. *Taiwan J Obstet Gynecol.* 2021;60(3):458-462. doi: 10.1016/j.tjog.2021.03.012. PubMed PMID: 33966728; PubMed Central PMCID: PMC7985931.
  23. Guo W, Li M, Dong Y, Zhou H, Zhang Z, Tian C, et al. Diabetes is a risk factor for the progression and prognosis of COVID-19. *Diabetes Metab Res Rev.* 2020;36(7):e3319. doi: 10.1002/dmrr.3319. PubMed PMID: 32233013; PubMed Central PMCID: PMC7228407.
  24. Nasrollahzadeh Sabet M, Khanalipour M, Gholami M, Sarli A, Rahimi Khorrami A, Esmaeilzadeh E. Prevalence, Clinical Manifestation and Mortality Rate in COVID-19 Patients With Underlying Diseases. *J Arak Uni Med Sci.* 2020;23(5):740-749. doi: 10.32598/jams.23.COV.5797.1.
  25. Schiffrin EL, Flack JM, Ito S, Muntner P, Webb RC. Hypertension and COVID-19. *Am J Hypertens.* 2020;33(5):373-374. doi: 10.1093/ajh/hpaa057. PubMed PMID: 32251498; PubMed Central PMCID: PMC7184512.
  26. Askary E, Poordast T, Shiravani Z, Ashraf MA, Hashemi A, Naseri R, 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. doi: 10.18502/ijrm.v19i2.8477. PubMed PMID: 33718763; PubMed Central PMCID: PMC7922300.
  27. Yu N, Li W, Kang Q, Xiong Z, Wang S, Lin X, 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):559-564. doi: 10.1016/S1473-3099(20)30176-6. PubMed PMID: 32220284; PubMed Central PMCID: PMC7158904.
  28. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med.* 2020;382(8):727-733. doi: 10.1056/NEJMoa2001017. PubMed PMID: 31978945; PubMed Central PMCID: PMC7092803.