

Clinical Features and Outcomes of 124 Pregnant Women Hospitalized with COVID-19: A Prospective Observational Study

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ABSTRACT Objective: Pregnancy is known to worsen the clinical course of coronavirus disease-2019 (COVID-19) compared to non-pregnant women of the same age. The aim of this study is to evaluate maternofetal and neonatal clinical features and outcomes of pregnant women with COVID-19. **Material and Methods:** For this prospective single-center study, data of 124 pregnant women who were hospitalized and treated for COVID-19 between April 20, 2020 and March 20, 2021 were collected. Clinical, laboratory and obstetric characteristics of pregnant women during hospitalization were recorded. **Results:** Of the pregnant women, 61% were symptomatic while hospitalized. Nine of the pregnant women were admitted to the intensive care unit, 4 required invasive mechanical ventilation, and two died during the hospitalization associated with COVID-19. Abortion occurred in 3 pregnant women. As maternofetal outcomes, 18% of pregnant women had preterm labor and 10% had fetal distress. The polymerase chain reaction (PCR) test of 46 pregnant women was positive during delivery, and the PCR test of 37 pregnant women was negative. Neonatal intensive care unit was required in 19% of newborns. COVID-19 PCR was positive in 2 newborns. Non-COVID-19 related death was observed in 1 premature newborn. **Conclusion:** Pregnancies complicated by COVID-19 infection should be followed closely due to the risk of adverse maternal and fetal outcomes.

Keywords: COVID-19; pregnancy; maternofetal; neonatal; outcomes

The severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) virus, which emerged in China in December 2019, caused coronavirus disease-2019 (COVID-19) disease and spread worldwide. COVID-19 is a multisystemic disease associated with severe morbidity and mortality.¹ The virus infects cells by binding to the angiotensin converting enzyme 2 receptor, which is predominantly expressed in the lung tissue.² While some of the asymptomatic or mildly symptomatic cases survive, in some, the infection may progress to the lower respiratory tract, causing pneumonia, acute respiratory distress syndrome, and ultimately multi-organ failure, resulting in death.³ COVID-19 infection has been shown to damage many organs directly and/or

through the excessive immune response it causes in the body.⁴

Pregnancy is a physiological condition that predisposes women to viral respiratory infections. Due to physiological changes in the immune and cardiopulmonary systems, pregnant women are more likely to develop serious illness after infection with respiratory viruses. It is well known that viral infections during pregnancy can have adverse effects on both mother and newborn.^{5,6} It is known that pregnant women have an increased risk of morbidity and mortality in respiratory tract infections such as influenza and SARS-CoV. Available data suggest that symptomatic pregnant women with COVID-19 are at

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greater risk of severe disease compared to their non-pregnant peers.^{7,8} Perinatal morbidity and mortality have been shown to be high in pregnant women with severe COVID-19 disease.⁹ It has been shown to be associated with poor perinatal and neonatal outcomes in neonates exposed to SARS-CoV-2.^{10,11} Despite current studies, limited information is available about SARS-CoV-2 infection in hospitalized pregnant women.

In this study, we aimed to investigate the demographic, clinical, obstetric and fetal characteristics of hospitalized pregnant women with COVID-19 and the effect of COVID-19 on pregnancy.

MATERIAL AND METHODS

STUDY POPULATION

The first COVID-19 case was defined on March 11, 2020 in Türkiye. Since then, a large proportion of government and university hospitals were modified to serve as pandemic centers and COVID-19 patients were hospitalized and treated according to national treatment guidelines. For this single-center prospective study, data of 124 pregnant women with COVID-19 who were hospitalized in a tertiary university hospital in Türkiye between April 20, 2020 and March 20, 2021 were analyzed (Figure 1). The SARS-CoV-2 real-time reverse-transcription polymerase chain reaction (RT-PCR) test of all pregnant women included in the study was found to be positive. Patients younger than 18 years of age and patients with unavailable follow-up information were excluded. The treatment of each case was left to the

discretion of attending physician and was planned according to the national guidelines updated by the Turkish Ministry of Health. This study was approved by the institutional review board and Republic of Türkiye Ministry of Health. The study complies with the principles of the Declaration of Helsinki. Informed consent form was obtained from the patients.

SARS-CoV-2 RNA was detected by real-time RT-PCR method in the Public Health Microbiology Reference Laboratory of the Ministry of Health. Firstly taking an oropharyngeal swab, then a nasal sample using the same swab and placed on the same transport broth. Nucleic acid amplification tests (NAAT) for SARS-CoV-2 virus routine confirmation of COVID-19 cases was performed by determining specific sequences of virus RNA with a NAAT test such as real-time RT-PCR, and validating it by nucleic acid sequence analysis when necessary. For newborns, RT-PCR test was performed from nasal and pharyngeal swab samples from mothers positive for SARS-CoV-2 within the first 24 hours after birth.

DATA COLLECTION

Epidemiological, demographic, clinical, laboratory parameters, obstetric characteristics and outcome data of the patients were obtained during hospitalization. Epidemiological, demographic and obstetric information of patients, including maternal age, maternal body mass index (BMI), comorbid diseases, gestational age at admission, parity, gravidity, pregnancy complications (such as gestational hypertension, gestational diabetes, preeclampsia, cervical

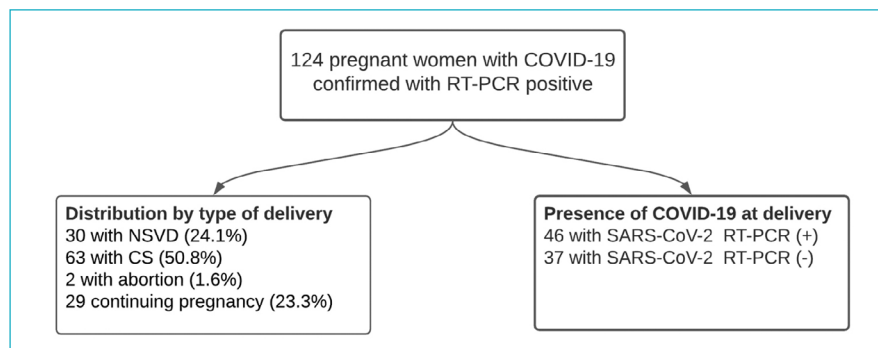


FIGURE 1: Clinical chart. RT-PCR: Reverse-transcription polymerase chain reaction; NSVD: Normal spontaneous vaginal delivery; CS: Cesarean section.

cerclage, and oligohydramnios), type of birth, cause of cesarean section (CS) and type of anesthesia (spinal and general) were collected during hospitalization. Laboratory results of admission complete blood count and biochemical parameters including liver and renal function, electrolytes, C-reactive protein (CRP), d-dimer and ferritin were collected from medical records. Laboratory values were determined by taking into account the appropriate intervals for pregnancy trimesters presented in the reference book.¹²

COVID-19 related symptoms and signs, hospitalization and discharge fever levels, mode of COVID-19 transmission, radiographic findings, type of treatment (anticoagulant, antibiotic, antiviral) and duration of hospital stay were recorded. The images of chest computed tomography (CT) scans were retrieved. The consent of the patient or her relative was obtained and a radiation shield was used to cover the uterus of the pregnant woman.

Maternal and fetal outcomes included abortion, time between COVID-19 diagnosis and birth preterm, delivery, preterm premature rupture of membranes (PPROM), preeclampsia, type of delivery, oligohydramnios, cervical cerclage, fetal distress, cephalopelvic disproportion (CPD), mother's hospitalization in intensive care unit (ICU) and death. Neonatal outcomes included birth weight, prematurity, neonatal ICU (NICU) admission, infant death, Apgar score and COVID-19 infection. When the babies were born, the 1st and 5th minutes Apgar scoring was made by the obstetrician and pediatrician who delivered. Pregnant women were compared with PCR+ patients during delivery and PCR negative during delivery. In addition, pregnant women were divided into 2 groups as normal spontaneous vaginal delivery (NSVD) and CS according to the type of delivery and compared (Figure 1).

STATISTICAL ANALYSIS

All statistical tests were conducted using the Statistical Package for the Social Sciences 21.0 for Windows (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test or Shapiro-Wilk test were used to analyze normality of the data. Normally distributed numerical parameters were expressed as mean±stan-

dard deviation, non-normally distributed numerical parameters were expressed as median (minimum-maximum), and categorical data are expressed as percentages. Chi-square test was used to assess differences in categorical variables between groups. Student's t-test or Mann-Whitney U test was used to compare unpaired samples as needed. Significance was assumed at a 2-sided $p < 0.05$.

ETHICAL CONSIDERATIONS

The Ethics Committee of Sakarya University approved the study (date: March 30, 2021, no: E-71522473-050.01.04-21464-221).

RESULTS

The demographic, clinical and laboratory characteristics of the pregnant women are given in Table 1. In our study in which 124 pregnant women were included, the mean age was measured as 28.5 ± 5.9 , and the BMI was found to be $24.4 \pm 3.5 \text{ kg/m}^2$. Pulmonary involvement was found on CT in 7 (5%) of the pregnant women. The signs and symptoms of the pregnant women were examined, fatigue was the most common (62%). The transmission from family members (34%) was observed most frequently. While hemoglobin and creatinine levels were below the reference range, CRP, d-dimer and ferritin values were above the reference range. While all patients received anticoagulant therapy, 44 (35%) patients received antibiotic and/or antiviral therapy.

It was observed that 9 (7%) of the patients were hospitalized in intensive care, 4 (3%) of them needed invasive mechanical ventilation and 2 (1%) died due to COVID-19 (Table 1).

The clinical characteristics of the patients related to pregnancy are given in Table 2. When the mode of delivery was examined, 30 (24%) had normal delivery, 63 (50%) had CS delivery and 3 (2%) had abortions. The CS indications of the patients were examined, 5 (4%) had COVID-19 pneumonia, 26 (21%) had cesarean history, 2 (1%) had preeclampsia, 12 (10%) had fetal distress, 4 (3%) had a history of stillbirth, 1 (1%) of them had PPRM, 3 (2%) had breech presentation, 9 (7%) had CPD, and 1 (1%) had intrauterine fetal death (Table 2).

TABLE 1: Demographic and clinical data of pregnant women.

Characteristic features	All pregnant (n=124)
Maternal age (years)	28.5±5.9
BMI	24.4±3.5
Smoking, n (%)	13 (10)
Comorbidity	
COPD, n (%)	2 (1)
Hypertension, n (%)	2 (1)
Diabetes mellitus, n (%)	3 (2)
Heart failure, n (%)	1 (1)
Pneumonia on CT, n (%)	7 (5)
Symptoms and signs	
Loss of taste, n (%)	20 (16)
Loss of smell, n (%)	22 (17)
Chest pain, n (%)	7 (5)
Diarrhea, n (%)	11 (9)
Sore throat, n (%)	41 (33)
Dyspnea, n (%)	59 (47)
Cough, n (%)	50 (40)
Weakness, n (%)	77 (62)
Myalgia, n (%)	62 (50)
Fever on admission, C°	37.7±0.4
Discharge fever, C°	36.5±0.2
Transmission	
COVID-19 infected environment, n (%)	2 (1)
COVID-19 infected contact, n (%)	8 (6)
COVID-19 in family members, n (%)	42 (34)
Unknown, n (%)	72 (58)
Laboratory	
WBC (/mm ³ ×10 ³)	8.9±3.6
Neutrophil (/mm ³ ×10 ³)	7.0±3.5
Lymphocyte (/mm ³ ×10 ³)	1.3 (0-20)
Hb (g/dL)	11.1±1.3
PLT (/mm ³ ×10 ³)	211.8±67.9
CRP mg/L	15 (1-313)
Urea mg/dL	14.6±4.9
Creatinine mg/dL	0.4±0.1
AST units/L	24.2±12.0
ALT units/L	14.7±6.5
D-dimer ng/mL	1,060 (50-15,000)
Ferritin ng/mL	25 (0-256)
SpO ₂ on admission, %	97.8±2.0
Use of anticoagulants, n (%)	124 (100)
Antibiotic or antiviral, n (%)	44 (35)
ICU admission, n (%)	9 (7)
Invasive mechanical ventilation, n (%)	4 (3)
Death, n (%)	2 (1)

Values are given as median (minimum-maximum); others given as mean (minimum-maximum); BMI: Body mass index; COPD: Chronic obstructive pulmonary disease; CT: Computer tomography; WBC: White blood cell; Hb: Hemoglobin; PLT: Platelets; CRP: C-reactive protein; AST: Aspartate transaminase; ALT: Alanine transaminase; ICU: Intensive care unit.

Maternofetal and neonatal outcomes of pregnant women with COVID-19 are examined, preeclampsia 3 (2%), PPROM 1 (1%), fetal distress 12 (10%), cervical cerclage 1 (1%), oligohydramnios 1 (1%), stillbirth 4 (3%), breech presentation 3 (2%), CPD 9 (7%), preterm labor 22 (18%), abortion 3 (2%), ICU admission 9 (7%) and death 2 (1%) was followed up in pregnant women (Table 3). One of the babies who were found to have positive RT-PCR for COVID-19 was completely asymptomatic and was born healthy by CS at normal term. Specific COVID-19 treatment was not administered to this asymptomatic baby. The second baby, who was positive for COVID-19 PCR, was born with normal vaginal delivery and meconium

TABLE 2: Obstetric characteristics of pregnant women with COVID-19.

Characteristic features	All pregnant (n=124)
Gestational age at admission (week)	31.3±9.5
Gravidity	2 (1-7)
Parity	1 (0-4)
Time between COVID-19 diagnosis and birth (day)	3 (0-182)
Pregnancy complications	
Gestational hypertension, n (%)	5 (4)
Preeclampsia, n (%)	3 (2)
Gestational diabetes, n (%)	6 (5)
Cervical cerclage, n (%)	1 (1)
Oligohydramnios, n (%)	1 (1)
Type of delivery	
Normal spontaneous vaginal delivery, n (%)	30 (24)
C/S, n (%)	63 (50)
Abortion, n (%)	3 (2)
Type of anesthesia	
General, n (%)	6 (5)
Spinal, n (%)	59 (47)
C/S indications	
COVID-19 pneumonia, n (%)	5 (4)
Repeat C/S, n (%)	26 (21)
Preeclampsia, n (%)	2 (1)
Fetal distress, n (%)	12 (10)
Stillbirth, n (%)	4 (3)
PPROM, n (%)	1 (1)
Breech presentation, n (%)	3 (2)
CPD, n (%)	9 (7)
Intrauterine fetal death, n (%)	1 (1)

Values are given as median (minimum-maximum); others given as mean (minimum-maximum); C/S: Cesarean section; PPROM: Preterm premature rupture of membranes; CPD: Cephalopelvic disproportion.

TABLE 3: Maternofetal and neonatal outcomes of pregnant women with COVID-19.

Characteristic features	All pregnant (n=124)
Maternofetal outcomes	
Preeclampsia, n (%)	3 (2)
PPROM, n (%)	1 (1)
Fetal distress, n (%)	12 (10)
Cervical cerclage, n (%)	1 (1)
Oligohydramnios, n (%)	1 (1)
Stillbirth, n (%)	4 (3)
Breech presentation, n (%)	3 (2)
CPD, n (%)	9 (7)
Preterm labor, n (%)	22 (18)
Abortion, n (%)	3 (2)
ICU admission, n (%)	9 (7)
Death, n (%)	2 (1)
Neonatal outcomes	
Birth weight	3,070 (500-4,030)
Prematurity, n (%)	22 (18)
NICU admission, n (%)	23 (19)
Death, n (%)	1 (1)
Apgar score	8.8±1.5
Positive RT-PCR for COVID-19	2 (2%)

Values are given as median (minimum-maximum); PPRM: Preterm premature rupture of membranes; CPD: Cephalopelvic disproportion; ICU: Intensive care unit; NICU: Neonatal intensive care unit; RT-PCR: Reverse-transcription polymerase chain reaction.

stained and had malnutrition. Oxygen support and total parenteral nutrition were applied to this baby. The second nasopharyngeal and oropharyngeal COVID-19 PCR result taken at the 24th hour of this baby was negative. Death was detected in an extremely premature baby at 23 weeks of gestation. The death of this baby was not associated with COVID-19.

Pregnant women are divided into 2 groups according to the type of delivery. Thirty of the pregnant women were delivered by NSVD and 63 by CS, and their clinical and demographic data are given in Table 4. While there was no statistically significant difference between the groups in terms of height, weight and smoking, the mean age was higher in the group with CS delivery compared to the NSVD group. While the mean age of the patients with NSVD was 26.0±5.8 years, the mean age of the patients with CS was 29.5±5.7 years and there was a statistically significant difference (p=0.007). When the laboratory

parameters were examined, it was observed that white blood cell and neutrophil levels were higher in individuals with NSVD, while other parameters were statistically similar between the groups (Table 4).

The pregnant women who had positive PCR test during delivery and those who had COVID-19 during pregnancy but whose PCR test was negative during delivery were compared. While the PCR test of 46 of the pregnant women was positive, the PCR test of 37 of them was negative and their clinical and demographic data are given in Table 5. When the laboratory parameters were examined, it was seen that there was no statistically significant difference between the groups. The APGAR score was statistically significantly higher (p=0.016) in the PCR (+) group (9.2±1.2) compared to the PCR (-) group (8.3±1.9). When the delivery types were compared between the groups, the frequencies of NSVD, CS delivery and abortion were similar (Table 5).

DISCUSSION

In this study, we presented the maternofetal and fetal outcomes of 124 pregnant women who were hospitalized and followed up. The main results of our study are as follows; i) 61% of pregnant women were symptomatic while hospitalized. ii) Nine of the pregnant women were admitted to the intensive care unit, 4 required invasive mechanical ventilation, and two died during the hospitalization associated with COVID-19. Abortion occurred in 3 pregnant women. iii) As maternofetal outcomes, 18% of pregnant women had preterm labor and 10% had fetal distress. COVID-19 PCR was positive in 2 newborns. Non-COVID-19 related death was observed in 1 premature newborn.

A large number of COVID-19 infections have also been reported among pregnant women.¹³⁻¹⁵

Pregnancy is a period in which immunity is partially suppressed. Since the immune system is suppressed due to pregnancy, susceptibility to viral infections occurs.⁶ Physiological changes during pregnancy make pregnant more vulnerable to severe infections.¹⁶ Changes in the respiratory system reduce maternal tolerance to hypoxia.¹⁷ In addition to the increase in mucosal edema and vasodilation in the upper respiratory tract due to the change in lung vol-

TABLE 4: Demographic, clinical and laboratory characteristics of pregnant women by type of delivery.

Characteristics	NSVD (n=30)	C/S (n=63)	p value
Maternal age (years)	26.0±5.8	29.5±5.7	0.007
BMI	163.1±6.4	163.6±5.7	0.705
Smoking, n (%)	6 (20)	5 (8)	0.092
Comorbidity			0.411
COPD, n (%)	1 (3)	-	
Hypertension, n (%)	-	2 (3)	
Diabetes mellitus, n (%)	-	3 (5)	
Heart failure, n (%)	-	1 (1)	
Pneumonia on CT, n (%)	3 (10)	4 (6)	0.533
Symptoms and signs			
Loss of taste, n (%)	6 (20)	8 (12)	0.357
Loss of smell, n (%)	8 (26)	7 (11)	0.057
Chest pain, n (%)	-	3 (5)	0.224
Diarrhea, n (%)	3 (10)	6 (9)	0.942
Sore throat, n (%)	10 (33)	15 (24)	0.333
Dyspnea, n (%)	14 (46)	25 (39)	0.523
Cough, n (%)	14 (46)	22 (35)	0.277
Weakness, n (%)	21 (70)	33 (52)	0.107
Myalgia, n (%)	16 (53)	25 (39)	0.215
Fever on admission, C°	36.7±0.4	36.6±0.3	0.105
Discharge fever, C°	36.5±0.2	36.5±0.1	0.069
Transmission			0.431
COVID-19 infected environment, n (%)	1 (3)	-	
COVID-19 infected contact, n (%)	3 (10)	4 (6)	
COVID-19 in family members, n (%)	11 (36)	22 (35)	
Unknown, n (%)	15 (50)	37 (58)	
Laboratory			
WBC (/mm ³ x10 ³)	10.9±5.0	8.8±2.5	0.037
Neutrophil (/mm ³ x10 ³)	9.0±5.1	6.8±2.4	0.034
Lymphocyte (/mm ³ x10 ³)	1.4 (1-20)	1.4 (0-3)	0.924
Hb (g/dL)	10.8±1.3	11.0±1.2	0.431
PLT (/mm ³ x10 ³)	216.3±82.9	211.4±65.5	0.760
CRP mg/L	12 (2-168)	18 (1-313)	0.326
Urea mg/dL	14.5±3.5	14.6±5.7	0.918
Creatinine mg/dL	0.4±0.1	0.4±0.1	0.167
AST units/L	21.2±10.5	25.1±13.0	0.167
ALT units/L	11.8±6.0	15.2±7.1	0.073
D-dimer ng/mL	1,479 (110-15,000)	1,235 (50-9,540)	0.194
Ferritin ng/mL	13 (1-166)	27 (0-256)	0.083
APGAR score	9.0±1.4	8.7±1.6	0.476
SpO ₂ on admission, %	98.0±1.1	97.6±2.6	0.397
Antibiotic or antiviral, n (%)	11 (36)	22 (35)	0.869
Gestational age at admission (week)	36.2±4.5	35.1±5.5	0.352
Time between COVID-19 diagnosis and birth (day)	4 (0-102)	5 (0-182)	0.888
ICU admission, n (%)	1 (3)	7 (11)	0.211
Death, n (%)	1 (3)	1 (1)	0.587

Values are given as median (minimum-maximum); others given as mean (minimum-maximum); NSVD: Normal spontaneous vaginal delivery; C/S: Cesarean section; BMI: Body mass index; COPD: Chronic obstructive pulmonary disease; CT: Computer tomography; WBC: White blood cell; Hb: Hemoglobin; PLT: Platelets; CRP: C-reactive protein; AST: Aspartate transaminase; ALT: Alanine transaminase; ICU: Intensive care unit.

TABLE 5: Comparison of pregnant women whose PCR test was positive during delivery and those who had COVID-19 during pregnancy but whose PCR test was negative during delivery.

	SARS-CoV-2 RT-PCR (+) (n=46)	SARS-CoV-2 RT-PCR (-) (n=37)	p value
Maternal age (years)	28.9±5.8	28.1±5.7	0.513
BMI	163.3±6.0	163.0±5.7	0.839
Smoking, n (%)	7 (15)	5 (13)	0.826
Comorbidity			0.450
COPD, n (%)	1 (2)	0 (0)	
Hypertension, n (%)	0 (0)	1 (3)	
Diabetes mellitus, n (%)	1 (2)	2 (5)	
Heart failure, n (%)	0 (0)	0 (0)	
Pneumonia on CT, n (%)	3 (6)	1 (3)	0.625
Symptoms and signs			
Loss of taste, n (%)	5 (11)	10 (27)	0.057
Loss of smell, n (%)	6 (13)	9 (24)	0.184
Chest pain, n (%)	1 (2)	1 (3)	0.876
Diarrhea, n (%)	4 (8)	5 (13)	0.483
Sore throat, n (%)	10 (22)	11 (30)	0.405
Dyspnea, n (%)	10 (21)	23 (62)	<0.001
Cough, n (%)	12 (26)	20 (54)	0.009
Weakness, n (%)	19 (41)	29 (78)	0.001
Myalgia, n (%)	15 (32)	22 (59)	0.014
Fever on admission, C°	36.6±0.4	36.6±0.3	0.360
Discharge fever, C°	36.5±0.2	36.4±0.0	0.332
Transmission			0.384
COVID-19 infected environment, n (%)	1 (2)	0 (0)	
COVID-19 infected contact, n (%)	2 (4)	5 (13)	
COVID-19 in family members, n (%)	16 (34)	13 (35)	
Unknown, n (%)	27 (58)	19 (51)	
Laboratory			
WBC (/mm ³ ×10 ³)	9.4±2.8	9.0±3.8	0.630
Neutrophil (/mm ³ ×10 ³)	7.4±2.6	7.0±3.7	0.627
Lymphocyte (/mm ³ ×10 ³)	1.5 (1-4)	1.3 (0-20)	0.700
Hb (g/dL)	11.0±1.2	11.2±1.4	0.373
PLT (/mm ³ ×10 ³)	222.4±77.0	204.8±60.8	0.260
CRP mg/L	9 (2-168)	18 (3-313)	0.183
Urea mg/dL	14.9±3.9	13.7±5.7	0.285
Creatinine mg/dL	0.4±0.1	0.4±0.1	0.744
AST units/L	23.4±9.7	23.7±14.4	0.895
ALT units/L	12.9±5.0	15.7±7.5	0.137
D-dimer ng/mL	1,560 (50-9,540)	1,040 (110-8,430)	0.190
Ferritin ng/mL	16 (0-249)	29 (2-256)	0.450
APGAR score	9.2±1.2	8.3±1.9	0.016
SpO ₂ on admission, %	98.1±1.1	97.8±1.3	0.299
Antibiotic or antiviral, n (%)	10 (21)	18 (48)	0.010
Gestational age at admission (week)	36.3±6.2	31.4±7.2	0.002
NSVD, n (%)	13 (28)	12 (32)	
CS, n (%)	31 (67)	24 (64)	
Abort, n (%)	2 (4)	1 (2)	
ICU admission, n (%)	3 (6)	3 (8)	0.781
Death, n (%)	2 (4)	-	0.500

Values are given as median (minimum-maximum); others given as mean (minimum-maximum); PCR: Polymerase chain reaction; BMI: Body mass index; COPD: Chronic obstructive pulmonary disease; CT: Computer tomography; WBC: White blood cell; Hb: Hemoglobin; PLT: Platelets; CRP: C-reactive protein; AST: Aspartate transaminase; ALT: Alanine transaminase; NSVD: Normal spontaneous vaginal delivery; C/S: Cesarean section; ICU: Intensive care unit.

ume and vasodilation, changes in T lymphocytes contribute to the increased susceptibility of pregnant women to being infected by intracellular organisms such as viruses.¹⁸

It has been reported that the H1N1 virus and the viruses that cause SARS-CoV and Middle East respiratory syndrome-CoV have serious effects on pregnancy (endotracheal intubation, admission to the intensive care unit, kidney failure, death).^{19,20} However, the effect of COVID-19 infection on pregnant women seems less severe.

According to our study results, the most common symptoms in hospitalization due to COVID-19 are fever, cough, weakness and dyspnea, similar to previous studies in terms of clinical symptoms.^{13,21} In a retrospective study by Chen et al., fetal distress and premature rupture of membranes occurred in only two of nine pregnant women with COVID-19 in the third trimester. No serious COVID-19 pneumonia and death was detected in pregnant women.¹³ Again, in a study by Zhu et al. involving nine pregnant women, fetal distress and preterm labor were reported in six newborns and seven of them were born by cesarean section.²² In 10 of the 18 pregnant women included in these two studies, delivery took place before 37 weeks of gestation due to obstetric complications such as premature rupture of membranes, preeclampsia and irregular contractions.^{13,22}

In a study conducted by Yan et al., 6.9% of pregnant women were admitted to the ICU. Mechanical ventilation was applied to two patients and maternal death was not observed. The mode of delivery in most cases was cesarean section, causing pneumonia due to COVID-19 in 38.8% of cases. Premature birth was observed before 37th gestational week in 21.2% of the cases.²¹ In our study, the rate of pregnant women with COVID-19 admitted to the ICU was 7.2%, similar to that observed in two European studies.^{23,24} In our study, the preterm birth rate was found to be 18% and it was found to be higher than low risk pregnancy without COVID-19.

Chen et al. reported that all patients were treated with antibiotics and antiviral drugs.¹³ Yan et al. found that almost all (94%) infected patients received antibiotic treatment.²¹ In our study, the rate of antibiotic

or antiviral use was found to be 35%. These differences are thought to be due to the diversity of treatment protocols in countries.

In our study, 50.8% of the patients had cesarean section, 24.1% NSVD, 3 pregnant women had abortus, and 23.3% of the pregnant women are still in the process of pregnancy. In the studies of Zhu et al. (77.7%), Chen et al. (100%), Liu et al. (90%), Yan et al. (89.5%), CS was performed, and CS was detected at a higher rate than in our study.^{13,14,21,22}

However, in the study of Yan et al., In 38.8% of cases, the cause of cesarean delivery was COVID-19 pneumonia.²¹ In our study, CS was applied in 4% of pregnant women due to COVID-19 pneumonia. The most frequent indications for CS were repeat CS (21%) and fetal distress (10%).

Newborns are in a high risk group due to immature immune systems and close contact with asymptomatic infected mothers after birth.²⁵ Pregnant women with COVID-19 with or without pneumonia are at higher risk of preeclampsia, preterm labor, abortion, and cesarean delivery, according to a recently published meta-analysis. Also, the risk of low birth weight and intrauterine fetal distress appears to be increased in newborns.²⁶ However, another study of eleven babies born to mothers with COVID-19 showed that the complications seen in newborns are significant and include prematurity, thrombocytopenia due to hepatic dysfunction, fetal distress and respiratory distress.²² Regarding the neonatal outcomes in our study, preterm birth was observed in 18%. NICU was required in 19% of newborns. In 2 newborns, COVID-19 PCR positive and complete recovery was achieved. Non-COVID-19 related death was observed in 1 premature newborn.

In a study conducted in our country that included 25 pregnant women, early hospitalization and medical treatment may alleviate symptoms, improve clinical course, and reduce the need for ICU in COVID-19 symptomatic pregnant patients.²⁷ In a case series of 8 pregnant women infected with COVID-19, the use of routine lung ultrasound after an obstetric ultrasound evaluation may significantly impact the clinical management of pregnant women with COVID-19.²⁸

First, this is a single center study and the sample size was relatively small. Second, markers indicating the severity of COVID-19, such as procalcitonin, lactate dehydrogenase, interleukin 6, and troponin, were not measured. Third, the fact that most of the pregnant women included in the study were in the 3rd trimester, making it difficult to detect COVID-19-related early complications.

CONCLUSION

In conclusion, all pregnant women with suspected COVID-19 infection should be screened and, if confirmed, both pregnant and fetus should be properly monitored for complications. Pregnant individuals should take all available precautions to avoid exposure to COVID-19. Clinicians should advise pregnant women and those considering pregnancy about the potential risk of COVID-19, and highlight measures to prevent infection with SARS-CoV-2 for pregnant women and their families. Further studies are needed to investigate maternofetal and neonatal outcomes.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Mehmet Musa Aslan; **Design:** Hilal Uslu Yuvacı; **Control/Supervision:** Mehmet Musa Aslan; **Data Collection and/or Processing:** Nigar Almadadova, Meltem Karabay; **Analysis and/or Interpretation:** Mehmet Musa Aslan, Hilal Uslu Yuvacı; **Literature Review:** Mehmet Musa Aslan; **Writing the Article:** Mehmet Musa Aslan; **Critical Review:** Arif Serhan Cevrioglu; **References and Fundings:** Selçuk Özden; **Materials:** Mehmet Sühha Bostancı; **Control:** İsmail Bıyık

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