Journal of
Kerman University of Medical Sciences

https://jkmu.kmu.ac.ir
10.34172/jkmu.3770
JKMU. 2025;32:3770

Original Article

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Study Amniotic Fluid Disorders in pregnant mothers with COVID-19 in Ardabil, Iran

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Abstract

Background: Pregnant individuals are considered a high-risk group for COVID-19, which has been linked to an elevated likelihood of adverse pregnancy outcomes. Nonetheless, the specific effect of SARS-CoV-2 infection on amniotic fluid volume is not fully understood. This study aimed to determine the incidence of amniotic fluid disorders (AFD) in pregnant women with COVID-19.

Methods: This cross-sectional analysis included 207 pregnant women diagnosed with COVID-19 at Alavi Hospital in Ardabil, Iran. Data were collected through patient interviews, physical assessments, medical records, and laboratory findings using a standardized checklist. Statistical analyses were conducted with SPSS software (version 25), considering a p-value below 0.05 as statistically significant.

Results: The mean age of participants was 28.3 ± 6.5 years. Among the cohort, 19 women (9.2%) with COVID-19 were diagnosed with an amniotic fluid disorder, with all cases identified as oligohydramnios. The occurrence of oligohydramnios showed significant associations with several factors: the trimester of COVID-19 infection ($P=0.007$), presence of dyspnea ($P=0.004$), extent of pulmonary involvement on imaging ($P=0.027$), overall disease severity ($P=0.001$), requirement for specific hospitalization wards (e.g., ICU) ($P=0.001$), delivery via cesarean section ($P=0.021$), and preterm birth ($P=0.001$).

Conclusion: The findings indicate a significantly higher incidence of oligohydramnios in women infected with COVID-19 during the third trimester, particularly among those exhibiting dyspnea and pulmonary involvement. Furthermore, oligohydramnios was significantly correlated with increased rates of cesarean delivery and preterm birth.

Keywords: Pregnancy, COVID-19, Amniotic fluid, Oligohydramnios, Perinatal outcomes

Citation: Farzipour S, Jalilvand F, Amani F, Rezazadeh Z. Study amniotic fluid disorders in pregnant mothers with COVID-19 in Ardabil, Iran. *Journal of Kerman University of Medical Sciences*. 2025;32:3770. doi:10.34172/jkmu.3770

Received: September 11, 2023, **Accepted**: November 3, 2025, **ePublished**:December 2, 2025

Introduction

In Wuhan, China, the coronavirus illness (COVID-19) was initially discovered in December 2019 (1). On March 11, 2020, the World Health Organization (WHO) declared a pandemic due to the virus's rapid global spread. By June 2023, over 768 million confirmed cases and more than 6.9 million deaths had been reported worldwide (2). Following the initial official confirmation of cases in February 2020, around 7.6 million illnesses and over 146,000 deaths occurred in Iran (3). Frequent early signs of COVID-19 include headache, diarrhea, myalgia, cough, and fever. A subset of patients develops severe pneumonia, necessitating intensive care unit (ICU) admission for 23-34% of hospitalized cases, with a mortality rate ranging from 4% to 15% (4).

There is a persistent worldwide health issue as a result of the high transmissibility and serious consequences (5). Due to physiological changes in the immunological and cardiovascular systems, pregnant women are a vulnerable group that may be more susceptible to severe COVID-19 symptoms (6). The data on the effects of COVID-19 during pregnancy is still developing and occasionally incongruous. According to a study in the U.S., the severity of the sickness is equal in pregnant and non-pregnant people (7), but other studies show that pregnant women are more likely to suffer from severe illness, be admitted to the intensive care unit, and require mechanical ventilation. According to a study by Ellington et al pregnant women with COVID-19 had a hospitalization rate of around one-third, which is far greater than the 5.8% rate seen in non-pregnant women (8).

Infection during the third trimester seems to be especially associated with an increased risk of problems (9). Maternal-fetal impacts have also been the focus of recent studies. There have been reports of transplacental transmission with possible fetal effects (11,12) and a preeclampsia-like condition in COVID-19 individuals (10). There have also been reports of the virus being

found in breast milk and amniotic fluid. According to a comprehensive review, pregnant women are more likely to develop severe COVID-19 compared to non-pregnant women (13). Furthermore, recent observational studies have shown that mild or asymptomatic COVID-19 during pregnancy is linked to a higher risk of negative outcomes, in addition to severe COVID-19 (14-17).

Given the ongoing uncertainty surrounding the relationship between COVID-19 and pregnancy complications, further investigation is crucial. This study aimed to determine the frequency of amniotic fluid disorders in pregnant women with COVID-19.

Methods

From early 2021 to the end of September 2022, this cross-sectional study was carried out at the Alavi Teaching and Medical Hospital in Ardabil, Iran. In this study, 207 pregnant women with a confirmed diagnosis of COVID-19—either by positive PCR test results or a combination of clinical symptoms and distinctive lung CT-scan findings—were included. Through patient examination, evaluation of hospital records, and laboratory results, data on demographics, clinical information relating to COVID-19, the presence of amniotic fluid disorder (AFD), and pregnancy outcomes were gathered and documented in a systematic checklist. Two groups of participants—those with and without AFD—were created.

The National Health Commission of China divided the severity of COVID-19 into four categories: mild, moderate, severe, and critical, in accordance with the fifth edition of the Guidelines on the Diagnosis and Treatment of COVID-19. Consenting pregnant mothers with a confirmed diagnosis of COVID-19 were recruited. Pre-existing pregnancy issues (e.g., gestational diabetes or preeclampsia), pregnancy termination because of these complications, vaginal discharge, pre-existing diabetes, hypertension, and fetal abnormalities were among the exclusion criteria. SPSS version 25 was used for statistical analysis. Fisher's exact test and the Chi-square test were used to assess categorical data. P-values below 0.05 were regarded as statistically significant. The data were summarized using descriptive statistics such as frequency distributions, means, and standard deviations.

Results

The study comprised 207 pregnant women. Among them, 19 (9.2%) were diagnosed with an amniotic fluid disorder. The majority of these women (15, 79%) were aged 20-39 years, and most had a normal Body Mass Index (BMI). Underlying diseases, excluding those listed in the exclusion criteria, were present in 6.3% of mothers, with three of these women belonging to the AFD group (Table 1). The incidence of oligohydramnios showed no significant association with maternal age, BMI, or underlying disease. A total of 188 patients (90.8%) did not have an amniotic fluid disorder (Figure 1).

Within the AFD group, 16 women (84.2%) contracted COVID-19 during their third trimester. Regarding obstetric history, 11 women (57.9%) had a gravidity of

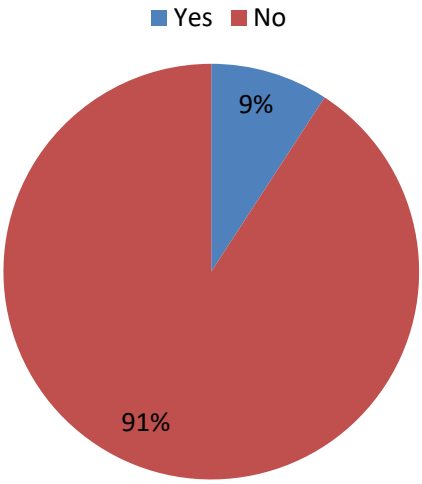

Figure 1. Frequency of amniotic fluid disorders in patients

Table 1. Amniotic fluid disorders (AFD) by mother age, BMI, and the mother's underlying diseases

Variables		AFD				*P* value*
		+		-		
		n	%	n	%	
Mother age (years)	15-19	5	10.5	18	9.6	0.007*
	20-29	7	36.8	92	48.9	
	30-39	8	42.1	71	37.8	
	40-45	2	10.5	7	3.7	
BMI	Normal	9	47.4	92	49	0.55
	Overweight	5	26.3	57	30.3	
	Obess	5	26.3	39	20.7	
Mother underlying other than excluded criteria	-	16	84.2	178	94.7	0.29
	+	3	15.8	10	5.3	

Chi-square test, * $P<0.01$.

1-2, and 13 (68.4%) had a parity of 1-2. The presence of oligohydramnios was significantly associated with the trimester of COVID-19 infection, disease severity, need for ICU admission, mode of delivery, and gestational age at birth, but not with gravidity or parity (Table 2). Furthermore, oligohydramnios was significantly correlated with the presence of dyspnea and the degree of pulmonary involvement identified on imaging (Table 3).

Discussion

The purpose of this study was to look into amniotic fluid problems in pregnant women with COVID-19. According to our findings, 9.2% of the participants in the research experienced an AFD, which only showed up as oligohydramnios. Compared to studies from Brazil (7.4%), Ahvaz (4.5%), and India (4.4%), this incidence rate is greater (18–20). The focus of our investigation on a hospitalized sample, who probably had more severe COVID-19 than the outpatient cohorts in the cited publications, may be the cause of this disparity. Patients with severe disease may be more susceptible to oligohydramnios (18–20). In contrast to our findings, Soto-Torres et al did not identify any change in amniotic fluid index between women who tested positive for SARS-CoV-2 and a control group (21).

This discrepancy could be explained by the fact that the majority of the cases in their research were asymptomatic or only mildly affected. However, investigations conducted in India by Jamal et al. and Khoiwal et al found that the rates of oligohydramnios were significantly higher, at 25.4% and 33.3%, respectively (22, 23). These discrepancies may result from variances in SARS-CoV-2 strains, the severity of the illness, the time of infection, medical resources, or methodological factors like sample size and oligohydramnios diagnostic standards. According to pre-pandemic research, the frequency of oligohydramnios ranged from 0.5% to 5% (24–27). A hypoxemic condition and maternal dehydration, which are more severe in severe instances and may result in oligohydramnios, could be the cause of the observed fluid loss in COVID-19 patients (21).

Our study's 14.5% preterm birth rate was comparable to Alibakhshi et al's 14.4% rate (19). A greater rate of 22.5% was found by Singh et al (18), and additional studies also show that pregnant women with COVID-19 have higher rates of premature births (28, 29). Although it is yet unknown if COVID-19 plays a direct or indirect role, a systematic study found that deteriorating maternal health increases the risk of premature delivery (30). A high rate of 70% cesarean sections was noted. A 100% cesarean rate in their cohort was reported by Li et al from China (31), and other studies similarly report high rates (18, 19).

Table 2. AFD by COVID-19 information, pregnancy outcome, and hospitalization section

Variables		AFD				*P* value
		+		-		
		n	%	n	%	
Trimester of suffering due to COVID-19	The first three months	0	0	8	4.26	0.007**
	The second three months	3	15.79	95	50.53	
	The third three months	16	84.21	85	45.21	
Previous Pregnancy	0	4	21.05	51	27.13	0.55
	1-2	11	57.89	100	53.19	
	3-4	3	15.79	34	18.09	
	>=5	1	5.26	3	1.6	
Parity	0	4	21.05	61	32.45	0.29
	1-2	13	68.42	111	59.04	
	3-4	1	5.26	14	7.45	
	>=5	1	5.26	2	1.06	
Severity of disease	Mild	1	5.26	99	52.66	0.001**
	Moderate	6	31.58	78	41.49	
	High	12	63.16	11	5.85	
Hospitalized section	General	12	63.16	188	100	0.001**
	ICU	7	36.84	0	0	
Type of dilevery	CS	17	89.47	128	68.09	0.021*
	Vaginal	1	5.26	59	31.38	
Gestational age	Term	9	47.37	166	88.3	0.001**
	Pre-term	9	47.37	21	11.17	

Chi-square test, * $P<0.05$, ** $P<0.01$.

Table 3. AFD by clinical, COVID-19 severity, and pulmonary involvement

Variables		AFD				*P* value
		+		-		
		n	%	n	%	
Dyspnea	-	1	5.26	72	38.3	0.004**
	+	18	94.74	116	61.7	
Cauch	-	5	26.32	71	37.77	0.324
	+	14	73.68	117	62.23	
Fever	-	10	52.63	121	64.36	0.314
	+	9	47.37	67	35.64	
Tremor (shaking in medicine)	-	10	52.63	123	65.43	0.27
	+	9	47.37	65	34.57	
Mialgy	-	17	89.47	133	70.74	0.08
	+	2	10.53	55	29.26	
Weakness and lethargy	-	15	78.95	141	75	0.7
	+	4	21.05	47	25	
Pharyngitis	-	17	89.47	156	82.98	0.47
	+	2	10.53	32	17.02	
Headache	-	19	100	170	90.43	0.38
	+	0	0	18	9.57	
Vomiting	-	19	100	183	97.34	0.47
	+	0	0	5	2.66	
Bleeding pain	-	18	94.74	5	2.66	0.32
	+	1	5.26	3	1.6	
diarrhea	-	19	100	4	2.13	0.52
	+	0	0	4	2.13	
Nausia	-	19	100	4	2.13	0.52
	+	0	0	4	2.13	
pulmonary involvement	-	1	5.26	4	2.13	0.03*
	+	18	94.74	4	2.13	

Chi-square test, * $P<0.05$, ** $P<0.01$.

According to a meta-analysis, the most common birth method for women with COVID-19 was cesarean delivery (30). The choice for surgical birth may have been motivated by worries about possible vertical transmission during vaginal delivery, even if some cesarean sections were medically indicated (19, 31). One important discovery was that individuals who had oligohydramnios were much more likely to have it if they had been infected during the third trimester, had dyspnea, pulmonary involvement, severe COVID-19, or needed intensive care unit care. Additionally, the oligohydramnios group had a considerably greater incidence of preterm birth and cesarean delivery.

There are not many studies that specifically look at AFD in COVID-19 pregnancies, and even fewer that look at the causes and results that are related. Nonetheless, our discovery that the occurrence of oligohydramnios is correlated with the severity of COVID-19 is consistent with the findings of Gomez et al (20). According to other studies, oligohydramnios is linked to poor perinatal outcomes, such as meconium aspiration, fetal growth restriction, irregular fetal heart rate, stillbirth, and an increased chance of cesarean delivery (32).

This study has some limitations, including its single-center design, the absence of a control group, and potential data gaps in medical records. Future multicenter studies with larger sample sizes and long-term follow-up of affected women are recommended.

Conclusion

The incidence of oligohydramnios was significantly higher in pregnant women with COVID-19 who were infected in the third trimester, presented with dyspnea and pulmonary involvement, had severe disease, or required ICU care. Oligohydramnios was, in turn, associated with significantly higher rates of cesarean delivery and preterm birth. Given that oligohydramnios is linked to adverse perinatal outcomes, it is prudent to conduct

ultrasound surveillance for its signs in pregnant women with COVID-19, in addition to routine care. Particular attention should be given to women with the identified risk factors, such as third-trimester infection, respiratory symptoms, pulmonary involvement, severe disease, and ICU admission.

Acknowledgments
The authors wish to thank the manager of Alavi hospital included in this study, for their support. And special thanks to all participants in this study.

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Writing–original draft: Shahla Farzipour, Faranak Jalilvand, Firouz Amani, Zahra Rezazadeh.

Competing Interests
None.

Ethical Approval
This study was approved by the Ethics Committee of Ardabil University of Medical Sciences (Ethical code: IR.ARUMS.MEDICINE.REC.1401.102).

Funding
This study was self-funded by the authors and received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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