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Analysis of vaginal delivery outcomes among pregnant women in Wuhan, China during the COVID-19 pandemic

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Abstract

Objective: To study vaginal delivery outcomes and neonatal prognosis and summarize the management of vaginal delivery during the COVID-19 pandemic.

Methods: A retrospective analysis of medical records and comparison of vaginal delivery outcomes between 10 pregnant women with clinical diagnosis of COVID-19 and 53 pregnant women without COVID-19 admitted to Zhongnan Hospital of Wuhan University between January 20 and March 2, 2020. Results of laboratory tests, imaging tests, and SARS-CoV-2 nucleic acid tests were also analyzed in neonates delivered by pregnant women with clinical diagnosis of COVID-19.

Results: There were no significant differences in gestational age, postpartum hemorrhage, and perineal resection rates between the two groups. There were no significant differences in birth weight of neonates and neonatal asphyxia rates between the two groups. Neonates delivered by pregnant women with clinical diagnosis of COVID-19 tested negative for SARS-CoV-2 infection.

Conclusions: Under the premise of full evaluation of vaginal delivery conditions and strict protection measures, pregnant women with ordinary type COVID-19 can try vaginal delivery without exacerbation of COVID-19 and without increasing the risk of SARS-CoV-2 infection in neonates.

KEYWORDS

China; COVID-19; Management; Neonatal outcome; Pregnancy; Vaginal delivery

1 | INTRODUCTION

The first case of coronavirus virus disease 2019 (COVID-19) was discovered in Wuhan in December 2019[1]; the virus spread rapidly in China and then globally.[2] Some scholars in China have summarized the clinical manifestations of COVID-19 in terms of patient epidemiology, symptoms and laboratory examinations, and pulmonary imaging characteristics, which indicate that it can lead to severe lung disease in some patients.[3] Others report interpersonal transmission during the latent period of the disease.[4] At present, prevention and control of COVID-19 remain in a critical period globally.

As the designated hospital for patients with COVID-19, Zhongnan Hospital of Wuhan University in Hubei province, China, accepted and treated pregnant women with confirmed or suspected COVID-19. The aim of the present study was to analyze vaginal delivery outcomes of pregnant women with clinical diagnosis of COVID-19 in the obstetric isolation ward and compare with pregnant women without COVID-19 in the general ward of our hospital. We also analyzed the prognosis of neonates delivered by pregnant woman with clinical diagnosis of COVID-19 to assess the effects of vaginal delivery on pregnant women and newborns. Furthermore, to protect the perinatal safety of this group of pregnant women and avoid intrahospital spread of COVID-19 (according to national guidelines for the diagnosis and treatment of COVID-19 and the treatment process of clinical cases in our hospital), we also summarized the vaginal delivery experience of pregnant women with COVID-19 for future reference.

2 | MATERIALS AND METHODS

We retrospectively reviewed the medical records of 10 pregnant women with clinical diagnosis of COVID-19 on the obstetric isolation ward and 53 pregnant women without COVID-19 on general wards admitted to Zhongnan Hospital of Wuhan University, Wuhan, China, between January 20 and March 2, 2020. All women delivered vaginally during this period. Ethical approval was obtained from the Medical Ethics Committee of Zhongnan Hospital of Wuhan University (No. 2020078). The study was a retrospective analysis of medical records and patient identities were anonymized; thus, informed consent was not required.

The diagnostic criteria of COVID-19 were according to the National Health Commission of China,[5] as follows:

2.1 | Suspected cases

Comprehensive analysis combining the following epidemiological history and clinical manifestations. Any one of the epidemiological history criteria or no epidemiological history, but two of the clinical manifestations. Epidemiological history comprised: (1) travel and residence history in Wuhan and surrounding areas or other communities with COVID-19 cases within 14 days before onset; (2) history of contact with COVID-19 cases within 14 days before onset; (3) contact with patients with fever or respiratory symptoms from Wuhan and surrounding areas or from communities with COVID-19 cases within 14 days before onset; (4) cluster onset. Clinical manifestations comprised: (1) fever and/or respiratory symptoms; (2) normal or reduced white blood cell count or reduced lymphocyte count in the early stages of onset.

2.2 | Clinical diagnosis cases

Suspected cases with imaging features of pneumonia.

2.3 | Confirmed cases

Clinically confirmed cases or suspected cases, with one of the following: (1) positive detection of SARS-CoV-2 using real-time reverse transcription polymerase chain reaction (RT-PCR); (2) viral gene sequence highly homologous to SARS-CoV-2.

We compared and analyzed the ages of pregnant women, number of pregnancies, gestational weeks, postpartum hemorrhage, perineal resection rates, blood counts, birth weight of neonates, and neonatal asphyxia rate. Neonates delivered by pregnant woman with clinical diagnosis of COVID-19 were transferred to the neonatal isolation ward; at the same time, blood count, throat swab test for SARS-CoV-2, and chest radiograph were performed.

A structured form in Excel (Microsoft; Redmond, WA, USA) was used to collate data. Statistical analysis was performed using SPSS version 19.0 (IBM, Armonk, NY, USA). Categorical data were expressed as rate and compared using the Fisher exact test. Continuous data were expressed as mean and standard deviation (SD) and compared using the *t* test. $P<0.05$ was considered statistically significant.

3 | RESULTS

A total of 88 pregnant women with confirmed or suspected COVID-19 were admitted to the obstetric isolation ward of Zhongnan Hospital of Wuhan University. Among them, 10 pregnant women with clinical diagnosis of COVID-19 delivered vaginally. Age ranged from 27–36 years. Number of pregnancies ranged from 1–4, number of deliveries ranged from 0–2, and gestational age ranged from 36 + 2 weeks/d to 40 + 2 weeks/d. Five of the 10 patients had low fever a few days before the onset of labor, four patients had mild respiratory symptoms, and one patient did not complain of particular discomfort. Data from laboratory tests showed that 9 of the 10 pregnant women had a low lymphocyte ratio. All 10 patients had a chest CT scan that showed typical findings of multiple patchy ground-glass shadows (Table 1).

Over the same period, 53 pregnant women without COVID-19 delivered vaginally on the general ward. Age ranged from 21–37 years. Number of pregnancies ranged from 1–4, number of deliveries ranged from 0–1, and gestational age ranged from 31 + 1 weeks/d to 42 weeks.

Pregnant women with clinical diagnosis of COVID-19 were older than those without COVID-19 ($P=0.042$). Pregnant women with clinical diagnosis of COVID-19 had more pregnancies than those without COVID-19 ($P=0.009$). There was no statistically significant difference in gestational age ($P=0.921$) or number of deliveries ($P=0.118$) between the two groups (Table 2). There was no statistically significant difference in premature rupture of membranes, premature delivery, neonatal asphyxia, amniotic fluid pollution, postpartum hemorrhage, or perineal lateral resection rate between the two groups (Table 3).

Among the 10 neonates delivered by pregnant women with clinical diagnosis of COVID-19, three neonates were self-discharged from the hospital owing to family refusal of neonatal pediatric treatment. Seven neonates were transferred to neonatal isolation according to management principles for neonates delivered by infected pregnant women. Among these seven, six were term infants and one was premature. Blood count test results of the seven neonates were normal. Throat swab tests for nucleic acid of SARS-CoV-2 performed twice (24 hours apart) in each of the seven neonates were all negative. One neonate's chest X-ray was considered to be hyaline membrane disease, which improved after treatment with pulmonary surfactant substitutes and symptomatic support therapy (Table 4).

4 | DISCUSSION

The present study reports clinical data from 10 pregnant women with clinical diagnosis of COVID-19. Based on our findings, the outcomes

TABLE 1 Clinical, laboratory, and imaging characteristics of 10 pregnant women with clinical diagnosis of COVID-19.

Characteristics	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Date of delivery, month/date	1/29	2/1	2/4	2/9	2/12	2/14	2/15	2/17	2/29	3/2
Age, y	29	36	30	36	36	30	33	33	27	29
Gestational age, weeks + days	40 + 4	39	39 + 5	37 + 6	38 + 1	40 + 1	39 + 4	36 + 2	40 + 2	37 + 2
No. of pregnancies	1	2	2	3	4	1	2	3	4	2
No. of deliveries	0	1	0	0	1	0	1	1	2	1
Clinical characteristics										
Fever	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes
Cough	No	Yes	No	No	No	Yes	Yes	No	No	No
Sore throat	Yes	No	No	No	No	No	No	No	No	No
Dyspnea	No	No	No	No	No	No	No	No	No	No
Chest pain	No	No	No	No	No	No	No	No	Yes	No
Myalgia	No	No	No	No	No	No	No	No	No	No
Diarrhea	No	No	No	No	No	No	No	No	No	No
Laboratory characteristics										
White blood cell count, $\times 10^9$ cells per L	9.42	8.68	12.53	10.86	9.45	9.38	10.61	11.67	8.75	9.63
Lymphocyte count, $\times 10^9$ cells per L	1.13	2.00	1.47	0.85	1.38	1.22	1.64	1.50	0.74	1.91
Lymphocyte ratio, %	12.0	23.0	11.7	7.8	14.7	13.0	15.5	12.8	8.5	19.8
C-reactive protein, mg/L	57.2	/	2.9	/	2.1	4.0	2.5	41.2	88.1	32.1
SARS-CoV-2 nucleic acid tests	No	No	No	No	No	No	No	No	No	No
Chest CT	+	+	+	+	+	+	+	+	+	+
Perineal incision	Yes	No	No	Yes	No	Yes	No	No	No	No
Postpartum hemorrhage, mL	200	300	300	300	200	300	200	200	200	250

of vaginal delivery such as volume of postpartum hemorrhage blood loss, perineal resection rate, blood counts, birth weight of neonates, and neonatal asphyxia rate were similar to pregnant women without COVID-19. There is no evidence to suggest that vaginal delivery could lead to severe adverse outcomes in pregnant women with clinical diagnosis of COVID-19 and infection in neonates.

COVID-19 is highly infectious. Due to the pathophysiological changes during pregnancy, pregnant women with pneumonia can easily progress to severe disease and the risk of adverse pregnancy outcomes is increased.[6] During the COVID-19 outbreak, cesarean delivery under general anesthesia has been the preferred mode of delivery to ensure a controllable delivery process, avoid emergency respiratory problems, and reduce the risk of infection exposure. However, the effects of these measures have not been fully proven.[7–9] During the COVID-19 pandemic, choosing cesarean delivery unnecessarily may cause long-term adverse effects.

The present study showed that the 10 patients were classified by clinical diagnosis with ordinary type COVID-19 in combination with the results of laboratory and imaging examination. At admission, these women had already begun labor and the fetal head was engaged. Therefore, we believed that there was no indication for cesarean delivery.

Before deciding on mode of delivery, in addition to routine laboratory tests, SARS-CoV-2 nucleic acid throat swab test and other respiratory pathogen detection, which is helpful for differential diagnosis, should also be completed. When necessary, chest CT could be performed—using radiation protection of the pregnant woman with abdominal lead covering—to evaluate lung lesions.[10] In our opinion,

TABLE 2 Comparison of characteristics between pregnant women with clinical diagnosis of COVID-19 and pregnant women without COVID-19.

Characteristics	Pregnant women with clinical diagnosis of COVID-19 (n=10)	Pregnant women without COVID-19 (n=53)	*t* value	*P* value
Age, y	31.90 ± 3.35	29.52 ± 3.31	2.075	0.042
Gestational age, w	38.50 ± 1.43	38.57 ± 1.99	0.100	0.921
No. of pregnancies	2.40 ± 1.07	1.58 ± 0.82	2.686	0.009
No. of deliveries	0.60 ± 0.55	0.32 ± 0.51	1.584	0.118

TABLE 3 Comparison of vaginal delivery outcomes between pregnant women with clinical diagnosis of COVID-19 and pregnant women without COVID-19.[a]

Outcome	Pregnant women with clinical diagnosis of COVID-19 (n=10)	Pregnant women without COVID-19 (n=53)	t/Fisher exact test	*P* value
Perineal incision	3 (30.0)	20 (37.7)	/	0.734
Amniotic fluid pollution	2 (20.0)	12 (22.6)	/	1.000
Postpartum hemorrhage, mL	245 ± 49.72	237 ± 85.99	0.258	0.797
Neonatal asphyxia	0 (0)	4 (7.5)	/	1.000
Premature delivery	1 (10.0)	5 (9.4)	/	1.000
Neonatal birth weight, g	3283 ± 449	3274 ± 456	0.059	0.953

[a]Values given as number (percentage) or mean ± SD unless otherwise indicated.

for ordinary type COVID-19 patients, vaginal delivery can be chosen if the relationship between the fetal head and pelvis is good and it is estimated that vaginal delivery can be performed within a short time.

During labor, pregnant women may cry, cough, and hyperventilate causing a large number of droplets and aerosols to be generated; this increases the possibility of exposure and infection of medical staff. Pregnant women were given nasal catheter oxygen inhalation and wore medical surgical masks in the isolation delivery room.[11] Freedom to move may alleviate pain and promote vaginal delivery during the labor process. Labor analgesia should be performed when necessary. To avoid excessive physical exertion and increased burden on cardiopulmonary function caused by a long labor, the labor process should be shortened as much as possible. If necessary, episiotomy, forceps delivery, and vacuum extraction can be used. After delivery of the fetus, oxytocin ergometrine and/or long-acting oxytocin should be used as early as possible to promote uterine contraction.

During postpartum observation in the present study, no exacerbation of respiratory symptoms was observed. Vaginal delivery was safe in this group of patients. However, one patient was considered to have acute fatty liver of pregnancy after the emergency vaginal delivery and chest CT showed progression of viral pneumonia, which improved after treatment in the ICU. It is necessary, therefore, to strengthen the monitoring of such patients after delivery. Multidisciplinary consultation and cooperation are needed, including respiratory teams, infection teams, and ICU to ensure perinatal safety.

Studies have shown that there was no clinical, laboratory, or radiological evidence of SARS coronavirus infection in 12 neonates delivered by pregnant women during the outbreak period of SARS in 2003.[12,13] Previous studies in our hospital have shown that there is no evidence of intrauterine infection caused by vertical transmission in women who develop COVID-19 in late pregnancy.[9] However, in order to reduce the possible risk of neonatal infection caused by mother-to-child contact, it is recommended that neonates delivered by pregnant women with confirmed or suspected COVID-19 should have their umbilical cords cut and cleaned as early as possible to reduce exposure time. In the present study, the neonates delivered by pregnant women with clinical diagnosis of COVID-19 were isolated from their mothers and admitted to the NICU immediately after birth for further observation. If routine laboratory tests were normal, throat swab tests for nucleic acid of SARS-CoV-2 were negative twice (at least 24 hours apart), and no signs of pneumonia were detected on chest radiograph, they could be discharged from the NICU. Breastfeeding was not permitted at the beginning because the infants and their mothers were isolated separately. Artificial feeding was provided for the infants isolated in the NICU for the first few days. The mothers were asked to maintain milk secretion by using breast pumps. After a 14-day isolation period, mothers were able to start breastfeeding when their chest CT scans showed no progression and throat swab tests for nucleic acid of SARS-CoV-2 were negative.

A recent retrospective clinical study reported that hospital-related transmission of COVID-19 is common.[14] Therefore, environmental management and personal protection should be carried out during vaginal delivery of pregnant women with confirmed or suspected COVID-19. Pregnant women with confirmed or suspected COVID-19 should complete vaginal delivery in a negative pressure isolation delivery room without birthing partners present. If the conditions are limited, delivery can also be completed in a single isolated delivery room. Medical personnel should be protected with an N95 respirator mask, disposable working cap, working clothes,

TABLE 4 Results for seven neonates delivered by pregnant women with clinical diagnosis of COVID-19.

	P4	P5	P6	P7	P8	P9	P10
White blood cell count, $\times 10^9$ cells per L	12.47	13.77	12.13	13.09	10.62	11.93	11.00
Lymphocyte count, $\times 10^9$ cells per L	2.25	4.30	2.45	3.88	2.12	2.72	2.56
Lymphocyte ratio, %	18.8	31.2	2.2	29.7	20.0	22.8	23.2
SARS-CoV-2 nucleic acid tests	—	—	—	—	—	—	—
Chest X-ray	—	—	—	—	—	—	Hyaline membrane disease

disposable isolation gown and protective clothing, double-layer gloves, shoe cover, goggles, and face shield. They should wear and remove the protective equipment correctly in a strictly delimited area (e.g. clean area, potential pollution area, pollution area) according to the standard process. Indoor air should be continuously fumigated and sterilized. The indoor floor and fixed facilities in the isolation delivery room (or the isolation ward) should be cleaned with chlorine-containing disinfectant after delivery.

The present study is limited by its small sample size and retrospective nature. Future investigations of these issues and follow-up studies of pregnant women with COVID-19 infection will be necessary to ascertain the safety of vaginal delivery during the COVID-19 pandemic. In addition, the cause of neonatal infection could be identified if SARS-CoV-2 nucleic acid can be detected in amniotic fluid, vaginal secretions, and perianal secretions in future.

In conclusion, under the premise of full evaluation of vaginal delivery conditions and strict protection measures, pregnant women with ordinary type COVID-19 can try vaginal delivery without exacerbation of COVID-19 and without increasing the risk of SARS-CoV-2 infection in the neonates.

AUTHOR CONTRIBUTIONS

JL and XH made substantial contributions to the study concept, design, and manuscript writing. QG contributed to conception and planning. CZ and LY made contributions to data acquisition, analysis, and interpretation. JL made substantial revisions to the manuscript.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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