

Analysis of vaginal delivery outcomes in pregnant women during the prevalence of COVID-19: a retrospective review of medical records

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Abstract

Objective: To study the pregnancy outcomes of vaginal delivery and neonatal prognosis during the epidemic of COVID-19, and to summarize the management of vaginal delivery. **Design:** Retrospective review of medical records **Setting:** Zhongnan Hospital of Wuhan University, Wuhan, China **Sample:** Pregnant women (n=63) with vaginal delivery from January 20 to March 02, 2020 **Methods:** Retrospectively analyzed the outcomes of vaginal delivery in 10 pregnant women with clinical diagnosis of COVID-19 and 53 pregnant women without COVID-19 from January 20 to March 02, 2020. The related laboratory tests, imaging tests and the SARS-CoV-2 nucleic acid tests results were also analyzed in neonates delivered by pregnant woman with clinical diagnosis of COVID-19. **Main Outcome Measures:** Delivery outcomes and neonatal outcomes **Results:** (1) There were no significant differences in gestational weeks, postpartum hemorrhage ($245\pm 49.72\text{ml}$ vs $237\pm 85.99\text{ml}$), and perineal resection rates (10% vs 7.55%) between the two groups. (2) There were no significant differences in birth weight of neonates ($3283\pm 449\text{g}$ vs $3274\pm 456\text{g}$) and neonatal asphyxia between the two groups. Results of the blood routine, throat swabs test for nucleic acid of SARS-CoV-2 and chest radiograph of neonates delivered by pregnant woman with clinical diagnosis of COVID-19 showed no signs of the SARS-CoV-2 infection. **Conclusions:** Pregnant women with mild COVID-19 can delivery vaginally without exacerbation of COVID-19 and without increasing the risk of SARS-CoV-2 infection in the neonates. **Keywords:** COVID-19; outcomes of vaginal delivery; neonatal prognosis; management **Tweetable abstract:** Pregnant women with mild COVID-19 can try vaginal delivery

Introduction

The first case of novel coronavirus-infected pneumonia (Corona Virus Disease 2019, COVID-19) was discovered in Wuhan in December 2019¹, and the epidemic spread rapidly in China and the whole world². Some scholars in China have summarized the clinical manifestations of COVID-19 from the aspects of patient epidemiology, symptoms and laboratory examinations, and pulmonary imaging characteristics, it is indicated that it can lead to severe lung disease in some patients³. And there is interpersonal transmission during the incubation period of the disease⁴. At present, the prevention and control of COVID-19 is still in a critical period in China and even in the world. As the designated hospital for patients with COVID-19, Wuhan University Zhongnan Hospital actively accepts and treats pregnant women with confirmed or suspected COVID-19. In this study, we compared the vaginal delivery outcomes between pregnant women with clinical diagnosis of COVID-19 in the obstetric isolation ward of our hospital and pregnant women without COVID-19 in the ordinary ward, and analyzed prognosis of neonates delivered by pregnant woman with clinical diagnosis of COVID-19. Indicate the effects of vaginal delivery on pregnant women and newborns after a full assessment. In order to protect the perinatal safety of this special group of pregnant women and avoid intrahospital spread of COVID-19, according to the national guidelines for the diagnosis and treatment of COVID-19 and the treatment process of the clinical cases in our hospital, we summarized the experience of vaginal delivery of pregnant women with confirmed or suspected COVID-19 during this epidemic, and put forward the following suggestions for reference.

Methods

Study population

Collected 10 cases of pregnant women with clinical diagnosis of COVID-19 in the obstetric isolation ward and 53 cases of pregnant women without COVID-19 in conventional wards of Zhongnan Hospital of Wuhan University, Wuhan, China, from January 20 to March 2, 2020. All the cases were vaginal delivery during the same period.

Study design

In this study, we compared the ages of pregnant women, times of pregnancy, gestational weeks, the amount of postpartum hemorrhage, perineal resection rates, birth weight of neonates and neonatal asphyxia. The neonates delivered by pregnant woman with clinical diagnosis of COVID-19 were transferred to the neonatal isolation ward, at the same time, the results of blood routine test, throat swabs test for nucleic acid of SARS-CoV-2 and chest radiograph were collected.

Diagnostic criteria

Suspected cases : Comprehensive analysis combining the following epidemiological history and clinical manifestations, there is any one of the epidemiological history or no epidemiological history, and has two points of the clinical manifestations.

(1) Epidemiological history: Travel and residence history in Wuhan and surrounding areas, or other communities with case reports within 14 days before the onset. History of contact with cases of COVID-19 in the 14 days before the onset. Have contacted patients with fever or respiratory symptoms from surrounding areas of Wuhan, or from communities with case reports in the 14 days before the onset; Cluster onset.

(2) Clinical manifestations: Fever and / or respiratory symptoms. Imaging features of the COVID-19. Normal or reduced white blood cell count or reduced lymphocyte count in the early stages of onset.

Clinical diagnosis cases : The suspected cases with the imaging features of pneumonia.

Confirmed case : Clinically confirmed cases or suspected cases, with one of the following etiological evidence.

(1) Real-time fluorescent RT-PCR detection of SARS-CoV-2 nucleic acid positive.

(2) The viral gene sequence is highly homologous to known SARS-CoV-2.⁵

Statistical analysis

Statistical analysis was performed using SPSS19.0 software. The counting data was expressed by rate, using Fisher's exact probability method. The measurement data was expressed by $\bar{x} \pm s$, using t test. The difference was considered statistically significant at $P < 0.05$.

Results

General information of the two groups

A total number 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 were vaginal delivery, the age of pregnant women delivered by vaginal delivery range from 27 to 36 years old, the pregnant times were 1-4, the number of deliveries were 0-2, the delivery weeks range from 36 weeks 2 days to 40 weeks 2 days. The amount of postpartum hemorrhage is 200-300ml. The results of relevant tests and lung computed tomography (CT) were detailed in Table 1.

In the same period, 53 pregnant women without COVID-19 were also vaginal delivery in the ordinary ward, the age ranged from 21 to 37 years old, the pregnancy times were 1-4, the number of deliveries were 0-1, the delivery weeks range from 31 weeks 1 days to 42 weeks. Pregnant women with clinical diagnosis COVID-19

are older than those without COVID-19 ($P = 0.042$). Pregnant women with clinical diagnosis COVID-19 have more pregnancy times than those without COVID-19 ($P = 0.009$). There was no statistically significant difference in the gestational weeks ($P = 0.921$) and number of deliveries ($P = 0.118$) between the two groups. (Table 2)

Comparison of vaginal delivery outcomes between the two groups

There was no significant difference between the two groups of pregnant women in terms of premature rupture of membranes, premature delivery, neonatal asphyxia, amniotic fluid pollution, the amount of postpartum hemorrhage, and perineal lateral resection rate. (Table 3)

Analysis of the results of neonates delivered by pregnant woman with clinical diagnosis COVID-19 in isolation ward

Among the 10 cases of neonates delivered by pregnant women with clinical diagnosis COVID-19 in the isolation ward, 3 cases were self-discharged from the hospital due to family refusal of neonatal pediatric treatment, and 7 cases were delivered to neonatal isolation according to management principles of neonates delivered by infected pregnant women. Among them, 6 were term infants and 1 was premature infants. The blood routine tests of the 7 neonates were normal, and throat swabs test for nucleic acid of SARS-CoV-2 were negative for twice. The result of chest radiography was considered to be hyaline membrane disease for one case, which improved after treatment with pulmonary surfactant substitutes and symptomatic support. The other neonates had the normal chest radiograph results. (Table 4)

Discussion

Main Findings

In this retrospective study, we analyzed and compared the outcomes of vaginal delivery between 10 pregnant women with clinically confirmed COVID-19 in the isolation ward and 53 pregnant women without COVID-19 in the general ward during the same period, and analyzed neonatal prognosis. The research showed there were no significant differences in gestational weeks, postpartum hemorrhage, perineal resection rates, neonatal weight, and neonatal asphyxia rates between the two groups. 10 neonates were delivered by pregnant women with clinical diagnosis COVID-19. Of these, 3 cases were self-discharged from the hospital because of refusal of neonatal pediatric treatment, although being informed of relevant risks. and 7 neonates were tested for SARS-CoV-2 nucleic acid throat swabs twice in succession, all of which were negative. Only 1 neonate was considered hyaline membrane disease by chest X-rays, No SARS-CoV-2 infection was detected in the chest radiographs of the remaining neonates.

Strengths and Limitations

As a COVID-19-designated hospital in Wuhan, the pregnant women with suspected and confirmed COVID-19 were admitted to our hospital. During the epidemic, cesarean section and general anesthesia were preferred to ensure that the delivery process is controllable, and to reduce emergency respiratory problems and reduce the risk of exposure to others. But the effects of these measures have not been fully proven^{6,7,8}. During the epidemic, choosing cesarean section blindly will cause the long-term adverse effects on women undoubtedly. This study analyzed the pneumonia conditions, delivery conditions, delivery outcomes, and neonatal infections in pregnant women with COVID-19, and evaluate the effect of vaginal delivery on pregnant women with COVID-19 and their newborns. Based on the above data, we provided more suggestions for the choice of delivery mode for pregnant women during the COVID-19 epidemic, summarized the methods of infection prevention during vaginal delivery and provide effective measures to avoid medical staff infection.

However, this study is limited by the small sample size, as the number of pregnant women with clinically confirmed COVID-19 underwent vaginal delivery is relatively small. This group of pregnant women are in accordance with the clinical diagnostic criteria for COVID-19 in China, but the pathogenic diagnosis is negative, but the false-negative results of SARS-CoV-2 nucleic acid throat swabs could not be excluded completely. For clinically diagnosed cases, close follow-up observation would be required. In addition, for

pregnant women with COVID-19 underwent vaginal delivery, it can provide an indirect etiology basis for the existence of neonatal infection if the SARS-CoV-2 nucleic acid detection of amniotic fluid, vaginal secretions and perianal secretions can be performed.

Interpretation

1. Delivery Methods for pregnant women with confirmed or suspected COVID-19

As we all known, the COVID-19 is highly infectious, and due to the pathophysiological changes during pregnancy, the SARS-CoV-2 infection in pregnancy women is easy to progress to severe disease, and the risk of adverse pregnancy outcomes is high⁹. In principle, caesarean section is recommended to terminate pregnancy during the epidemic period⁶. In the following cases, caesarean section should be the main choice: With pregnancy-related complications and has indications for emergency cesarean section; Already in labor, but the conditions for vaginal delivery are not good enough to make a short-term vaginal delivery; Pregnant women with severe or critical COVID-19⁵ cannot tolerate vaginal delivery.

In our research, the 10 cases of pregnant women with clinical diagnosis COVID-19 in isolation ward terminated pregnancy by vaginal delivery were classified as mild patients in combination with the results of laboratory and imaging examination. After admission, they already had regular uterine contraction, the fetal head was well connected, the fetal presentation was low, and all of them have officially entered the labor process. Therefore, we believe that there is no indication for cesarean section. The primipara is in the late stage of the active period or enters the second stage of labor, the relationship of fetal head and pelvic is good, it is estimated that the vaginal delivery can be performed in a short time. The multipara has already entered the labor process, the relationship of fetal head and pelvic relationship is good, it is estimated that the vaginal delivery can be performed within a short time. Vaginal delivery can also be selected in the above cases. Before deciding on the delivery method, in addition to the rapid improvement of routine laboratory tests, SARS-CoV-2 nucleic acid throat swab test, serum SARS-CoV-2 antibody test, and other respiratory pathogen detection which is helpful for differential diagnosis should be also finished. If necessary, perform bedside ultrasound to assess the situation of the fetus and appendages. Pregnant women are the same as non-pregnant patients. X-rays and CT are important methods for diagnosing COVID-19 and evaluating the condition. When necessary, check the lung CT (radiation low-dose screening for lung CT with conditions available) under the radiation protection of the pregnant woman with abdominal lead covering, which can be used to evaluate the lung lesions¹⁰.

2. Management of pregnant women with confirmed or suspected COVID-19 during vaginal delivery and the pregnancy outcomes.

During the course of labor, due to the intolerability of the labor pains, the cooperation degree of the pregnant women is reduced, they may cry, cough, hyperventilate and so on, thus, a large number of droplets and aerosols are generated, which increases the exposure and infection possibility of the medical staff. Thus we should strengthen the humanistic care for pregnant women, actively give them guidance, comfort and encouragement in the process of delivery, effectively communicate with pregnant women, stabilize the mood of pregnant women, and help them to eliminate their fear. Pregnant women with confirmed or suspected COVID-19 were given nasal catheter oxygen inhalation immediately after entering the isolation delivery room (or isolation ward), and wore medical surgical masks¹¹. Provide energy support, free position can be used to promote vaginal delivery and try to alleviate the pain and discomfort of pregnant women. Continuous ECG monitoring if necessary. In order to avoid too long labor process caused excessive physical consumption of pregnant women and increase the burden of cardiopulmonary function, on the premise of ensuring the safety of the mother and fetus, the labor process should be shortened as much as possible to reduce the exposure time of the fetus in the obstetric canal. If necessary, episiotomy, forceps operation and vacuum extraction can be used as midwifery. Timely compress and hemostasis the perineal wound to reduce the contact between fetus and mother blood. In the process of delivery, pay attention to avoid the pollution caused by amniotic fluid and blood splashing, absorbent mattress mats can be laid on the floor around the delivery bed, and disposable sterile liquid storage bag can be placed under the buttocks of pregnant women

to collect amniotic fluid and blood. After delivery of the fetus, oxytocin should be used as early as possible to promote uterine contraction, if necessary, ergometrine and/or long-acting oxytocin should be used in time to promote uterine contraction. Take other necessary measures to actively prevent postpartum hemorrhage according to the situation. After the delivery of fetus and placenta, routinely check the soft birth canal and suture the perineal incision wound or perineal laceration in time. Observed in the isolation room for 2 hours after delivery, or in the isolation ward under the supervision of the midwife for 2 hours. Strictly monitor vital signs, observe uterine contractions and vaginal bleeding, meanwhile, provide postnatal care for parturient women.

In this retrospective study, 10 pregnant women in the isolation ward of Obstetrics had no significant abnormality in the continuous monitoring of vital signs and blood oxygen saturation during the labor process, and the labor process was smooth. The second labor process was 10 minutes to 1 hour, no forceps and fetal head suction attendant midwifery. Only 3 cases of these primiparas underwent perineal resection to shorten the labor process and avoid severe perineal lacerations considering the possibility of fetal overgrowth. There was no significant difference in the amount of postpartum hemorrhage between the pregnant women with confirmed or suspected COVID-19 and the pregnant women without COVID-19. During the postpartum observation, no exacerbation of respiratory symptoms was observed in all cases. However, one patient considered acute fatty liver during pregnancy after the emergency vaginal delivery, and the lung CT showed the progression of viral pneumonia, which improved after the treatment in ICU. Therefore, it is necessary to strengthen the monitoring of such patients after delivery, just as important, the infectious diseases indicators and lung CT should be rechecked in time. At sometimes, it is necessary to carry out multidisciplinary consultation and cooperation including respiratory department, infection department and ICU to ensure perinatal safety.

3. Management and outcomes of neonates delivered by pregnant women with confirmed or suspected COVID-19

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 for intrauterine infection caused by vertical transmission in women who develop COVID-19 in late pregnancy⁸. However, in order to reduce the risk of neonatal infection caused by mother-to-child contact, it is recommended that neonates delivered by pregnant woman with confirmed or suspected COVID-19 should have their umbilical cords cut and cleaned as early as possible to reduce the exposure time. The Apgar score of the neonate was normal or returned to normal after the initial resuscitation, after routine treatment by the midwife, the neonate was delivered to the pediatrician outside the isolation delivery room (or outside the isolation ward) and immediately placed in a transfer incubator equipped with ECG monitoring equipment, and then transferred to neonatal isolation ward for observation and treatment through a special passage.

4. Protective measures during vaginal delivery of pregnant women with confirmed or suspected COVID-19

The SARS-CoV-2 is mostly transmitted through respiratory tract and exposed to infection. In a recent retrospective clinical study, it has been pointed out that the hospital related transmission of COVID-19 is not uncommon¹⁴. Therefore, environmental management and personal protection should be carried out in the vaginal delivery of pregnant women with confirmed or suspected COVID-19.

If the department of obstetrics already has a negative pressure isolation delivery room, pregnant women with confirmed or suspected COVID-19 should, in principle, complete vaginal delivery in the negative pressure isolation delivery room. If the conditions are limited, there is no negative pressure isolation delivery room, the delivery can also be completed in a single isolated delivery room. The isolation delivery room should be provided with three areas and three passages, the three areas refer to clean areas, semi-polluted areas, and polluted areas, the three passages refer to medical personnel passages, maternal transport-only passages, and dirt passages. The central air conditioning circulation system should be closed, use plastic sheeting to close each vent, and use electric heating equipment to maintain the indoor temperature if necessary. The

delivery room should be simplified with only necessary facilities such as delivery bed and neonatal radiation table. The delivery room should be simplified with only necessary facilities such as delivery bed and neonatal radiation table. In case of limited conditions or emergency situations, vaginal delivery can be carried out in isolation ward under strict protection.

In the process of delivery, the number of attendants should be as few as possible, and the number of medical staff required for treatment should be reduced to a minimum in the isolation delivery room (or isolation ward). Only one senior midwife and one first-line obstetrician stay in the isolation delivery room, with two-level protection, if conditions permit, three-level protection can be provided, i.e. wearing positive pressure headgear or full-breathing protector, and the midwife can wear disposable waterproof overshoes. The second-line obstetrician and pediatrician can take two-level protective measures and stand by outside the isolation delivery room (or isolation ward) to prepare for the emergency situation of pregnant women and newborns.

Placental tissue is disposed according to the principle of infectious biological waste disposal. It is packed in double-layer yellow medical garbage bags in the isolation delivery room (or the isolation ward), the two-layer garbage bags are sealed in layers to ensure tight sealing, and marked with “COVID-19” and “placenta”, after the surface was sprayed with 1000mg/L chlorine-containing disinfectant. Reusable medical equipment can be reused in a special instrument box, after 30 minutes of immersion in 2000mg/L chlorine-containing disinfectant, sealed in layers with a double-layer yellow medical garbage bag, and marked with “COVID-19”, collected and cleaned by a special person, then complete the subsequent sterilization. If the delivery is completed in an isolated delivery room, the indoor air is continuously fumigated and sterilized using a vaporized hydrogen peroxide machine in the closed state for 2 hours; if the delivery is completed in an isolated ward, the indoor air is disinfected by a human-machine coexisting air disinfection machine for 4 hours. The indoor floor should be cleaned with 2000mg/L chlorine-containing disinfectant, and the fixed facilities in the isolation delivery room (or the isolation ward) should be wiped with 1000mg/L chlorine-containing disinfectant. The surface that was in contact with the patient's body fluids, blood and other contaminated surfaces shall be treated with 2000mg/L - 5000mg/L chlorine-containing disinfectant. Indoor precision medical supplies, such as ECG monitors, stethoscopes, fetal heart monitors, infusion pumps, etc. can be thoroughly wiped and disinfected with 75% ethanol solution or 1000mg/L chlorine-containing disinfectant.

Conclusion

This is the first report to retrospectively evaluate the pregnancy outcomes of vaginal delivery and neonatal prognosis during the epidemic of COVID-19. On the premise of full evaluation of the vaginal delivery conditions and strict protection measures, pregnant women with mild COVID-19 can try vaginal delivery without exacerbation of COVID-19 and without increasing the risk of SARS-CoV-2 infection in the neonates.

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Disclosure of Interests

The authors report no conflict of interest. Completed disclosure of interest forms are available to view online as supporting information.

Contribution to authorship

JL and XH made substantial contributions to the study concept, design and writing up of the work. QG took part in the conception, planning. CZ and LY made contributions to data acquisition, analysis, and interpretation. YZ, JL and WZ made substantial revisions to the manuscript.

Details of Ethics Approval

The study was approved by the medical ethics committee of Zhongnan Hospital of Wuhan University (No2020078, 19th March 2020)

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Table 1 Clinical, laboratory and imaging characteristics of pregnant women with clinical diagnosis of COVID-19 in obstetric isolation ward

	P 1	P2	P3	P4	P5	P6	P7	P8	P9
	P 1	P2	P3	P4	P5	P6	P7	P8	P9
Date of delivery	1.29	2.1	2.4	2.9	2.12	2.14	2.15	2.17	2.29
Age	29	36	30	36	36	30	33	33	27
Delivery weeks (weeks+days)	40+4	39	39+5	37+6	38+1	40+1	39+4	36+2	40+2
Pregnancy times	1	2	2	3	4	1	2	3	4
Number of deliveries	0	1	0	0	1	0	1	1	2
Clinical characteristics									
Fever	No	No	Yes	No	Yes	No	No	Yes	Yes
Cough	No	Yes	No	No	No	Yes	Yes	No	No
Sore throat	Yes	No	No	No	No	No	No	No	No
Dyspnea	No	No	No	No	No	No	No	No	No
Chest pain	No	No	No	No	No	No	No	No	Yes
Myalgia	No	No	No	No	No	No	No	No	No
Diarrhoea	No	No	No	No	No	No	No	No	No
Laboratory characteristics									
White blood cell count (×10 ⁹ cells per L)	9.42	8.68	12.53	10.86	9.45	9.38	10.61	11.67	8.75
Lymphocyte count (×10 ⁹ cells per L)	1.13	2	1.47	0.85 —	1.38	1.22	1.64	1.5	0.74 —
Lymphocyte ratio (%)	12 —	23	11.7 —	7.8 —	14.7 —	13 —	15.5 —	12.8 —	8.5 —

	P 1	P2	P3	P4	P5	P6	P7	P8	P9
C-reactive protein (mg/L)	57.2 —	/	2.86	/	2.1	3.99	2.5	41.2 —	88.09 —
SARS-CoV-2 nucleic acid tests	No	No	No	No	No	No	No	No	No
Lung CT	+	+	+	+	+	+	+	+	+
Perineal incision	Yes	No	No	Yes	No	Yes	No	No	No
Postpartum hemorrhage(ml)	200	300	300	300	200	300	200	200	200

Table 2 Comparison of general information between pregnant women with clinical diagnosis COVID-19 and pregnant women without COVID-19

	pregnant women with suspected COVID-19	pregnant women without COVID-19	<i>t/Fisher</i>
Perineal incision rate	30% (3/10)	37.74% (20/53)	-
amniotic fluid pollution	20% (2/10)	22.64% (12/53)	-
Postpartum hemorrhage(ml)	245±49.72	237±85.99	0.258
neonatal asphyxia	0(0/10)	4	-
premature delivery rate	10% (1/10)	7.55% (4/53)	-
birth weight of neonates(g)	3283±449	3274±456	0.059

Table 3 Comparison of vaginal delivery outcomes between pregnant women with clinical diagnosis COVID-19 and pregnant women without COVID-19

Table 4 Results of neonates delivered by pregnant women with clinically confirmed COVID-19

	P4	P5	P6	P7	P8	P9	P10
White blood cell count (×10 ⁹ cells per L)	12.47	13.77	12.13	13.09	10.62	11.93	11.0
Lymphocyte count (×10 ⁹ cells per L)	2.25	4.3	2.45	3.88	2.12	2.72	2.56
Lymphocyte ratio (%)	18.80	31.2	2.20	29.7	20	22.80	23.2
SARS-CoV-2 nucleic acid tests	No	No	No	No	No	No	No
chest X-rays	-	-	-	-	-	-	hyaline membrane disease