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Anesthetic management of cesarean section in COVID-19-positive pregnant women in Japan: Three case reports and review of the literature

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ABSTRACT

Cesarean delivery may be performed if a pregnant woman develops coronavirus disease 2019 (COVID-19) in the prenatal period; however, perioperative management is controversial. Herein, we report the anesthetic management of cesarean sections in three pregnant women with COVID-19. In addition, we reviewed the literature on perioperative anesthesia management in pregnant women with COVID-19. Three pregnant women between the 37th and 38th weeks of gestation developed COVID-19 and were transferred to our hospital for cesarean section. Intraoperative spinal anesthesia was administered, and postoperative analgesia included intravenous morphine. Postoperatively, all patients were administered anticoagulant therapy. We used a negative pressure-controlled operating room for the cesarean sections, and the staff used Level 3 personal protective equipment with N95 masks, face shields, double gloves, full-body gowns, and shoe covers. None of the operating room staff, including the anesthesiologist, were infected with COVID-19 due to patient care. Spinal anesthesia, rather than general anesthesia, is recommended for cesarean sections in pregnant women with COVID-19. In addition to the risk of thrombosis, it is necessary to manage anesthesia in pregnant women infected with COVID-19 while considering accessibility to the ward for postoperative management and familiarity of ward staff.

Key words: *Coronavirus disease 2019*, *Cesarean section*, *Spinal anesthesia*, *Analgesia*, *Thrombosis*

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has spread worldwide since the end of 2019, causing a pandemic that is ongoing in 2022[21]. Symptoms of COVID-19 vary from mild to severe. In severe cases, COVID-19 is associated with acute respiratory distress syndrome, sepsis, and multiple-organ failure[8]. COVID-19 is predominantly transmitted by respiratory droplets of SARS coronavirus 2[8,21]. COVID-19 is transmitted through contact transmission and aerosol infection. This virus is highly infectious and survives on metals for a relatively long period. Therefore, it is difficult to completely avoid infection, even in daily life, and pregnant women in the perinatal period may also be infected[19].

Currently, there is no evidence that pregnant women are more likely to be infected or to become more severely infected with COVID-19 than other adults[3,14]. However, owing to the peculiarities of the perinatal period, there are concerns regarding the management of pregnant women who develop COVID-19. A management plan that considers both patient safety and the spread of infection among healthcare professionals needs to be developed[15]. Therefore, we need to be familiar with social factors such as infection-control equipment, medical resources, and facility personnel, as well as medical factors such as the risk of respiratory complications and thrombosis due to COVID-19 in pregnant women[20].

We performed cesarean sections under anesthetic management in three pregnant women who developed COVID-19 during pregnancy. Based on the evidence of COVID-19-infected patient management, anesthesia management was performed according to the management protocol for COVID-19 patients in our hospital. In accordance with the CARE reporting checklist, we present the following cases.

Case presentation

<Case 1>

A 40-year-old, 38-week pregnant woman was infected by her cohabiting daughter and developed COVID-19. She underwent a cesarean section because of labor during hospitalization. Intraoperative spinal anesthesia was administered, and postoperative analgesia included morphine by intravenous patient-controlled analgesia (IV PCA) and acetaminophen. As her preoperative D-dimer level was 6.8 μg/mL, she received a subcutaneous injection of enoxaparin up to postoperative day (POD) 8. The

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Table 1 Patient background and summary

	No. 1	No. 2	No. 3
Age (years)	40	34	36
Height (cm)	161	160	164
Body weight (kg)	60	56	52
Weeks of pregnancy (weeks)	38	38	37
Coronavirus (COVID-19) Vaccination	None	Twice	Twice
Transmission route	Domestic infection	Unknown	Domestic infection
PCR test	Positive	Positive	Positive
Fever	Yes	Yes	Yes
Respiratory symptoms	No	Sore throat, Cough, Runny nose	No
D-dimer test (μg/mL)	6.8	2.0	4.8
Anesthesia	Spinal anesthesia	Spinal anesthesia	Spinal anesthesia
Drugs used for anesthesia	0.5% Bupivacaine 12 mg	0.5% Bupivacaine 12 mg Fentanyl 10 μg	0.5% Bupivacaine 12 mg Fentanyl 10 μg
Surgery time (min)	66	59	52
Bleeding including amniotic fluid (mL)	688	932	331
Postoperative anticoagulant therapy	Enoxaparin 4,000 IU/day	Heparin 10,000 U/day	Enoxaparin 4,000 IU/day
Postoperative analgesia	Morphine IV-PCA Acetaminophen	Morphine IV-PCA Acetaminophen Celecoxib	Morphine IV-PCA Acetaminophen Celecoxib
Complications	No	Drug-induced liver damage	No
Discharge	POD 9	POD 12	POD 7

PCR, polymerase chain reaction; IV PCA, intravenous patient-controlled analgesia; POD, postoperative day.

patient was discharged on POD 9.

<Case 2>

A 34-year-old, 38-week pregnant woman was diagnosed with COVID-19 and fever, following complaints of runny nose and nasal congestion. A cesarean section was planned because of the potential for labor during COVID-19 treatment. Intraoperative spinal anesthesia was administered, and postoperative analgesia included morphine by IV PCA and acetaminophen. Her preoperative D-dimer levels rose to 2.0 μg/mL; therefore, she received a subcutaneous injection of heparin postoperatively. She developed liver damage after surgery; therefore, continuous administration of heparin and acetaminophen was discontinued, and celecoxib was administered orally. The patient was discharged on POD 12.

<Case 3>

A 36-year-old, 37-week pregnant woman contracted COVID-19 after cohabitation with her son. She underwent cesarean section because of labor pain during COVID-19 treatment. Intraoperative anesthesia was administered using spinal anesthesia, and postoperative analgesia included morphine by IV PCA, acetaminophen, and celecoxib. She received a subcutaneous injection of enoxaparin as anticoagulant therapy postoperatively because she had a D-dimer level of 4.8 μg/mL on preoperative examination. The patient was discharged on POD 7.

Table 1 summarizes these three cases. (Table 1)

DISCUSSION

In our hospital, intraoperative anesthesia for cesarean section is usually administered using combined spinal and epidural anesthesia, whereas postoperative analgesia is administered using patient-controlled epidural analgesia. However, in the described cases, the anesthesia method was decided considering the risk of thrombosis due to COVID-19 and the difficulty of entering and exiting the isolation ward of COVID-19 patients after surgery. Intraoperative spinal anesthesia was administered, and postoperative analgesia included morphine by IV PCA. Perioperative management of pregnant women with COVID-19 remains controversial.

i) Maternal COVID-19 infection

Current evidence on COVID-19 infection during pregnancy supports a lack of vertical transmission[4,23]. The SARS-CoV-2 virus has not been detected in the amniotic fluid, cord blood, or breast milk of pregnant women with COVID-19[3,10]. Therefore, cesarean section was not selected solely because the patients were COVID-19 pos-

Figure 1 Personal protective equipment for COVID-19 patients. Infection protection for operating room staff during surgery for COVID-19-infected patients: N95 masks, face shields, double gloves, full-body gowns, and shoe covers.

itive. However, if COVID-19 is mild or asymptomatic, vaginal delivery is considered possible, though labor during delivery may generate aerosols and spread the infection[22]. Vaginal delivery of COVID-19-infected pregnant women requires an operation in a negative pressure chamber to prevent the spread of the infection, as well as a large amount of manpower and medical resources[12,17]. In particular, in case of first delivery, it takes approximately 10 h on average to deliver; therefore, the aerosol produced by deep breathing during labor may spread the infection to the medical staff. Therefore, depending on the facility, choosing a cesarean section for pregnant women infected with COVID-19 is unavoidable. As we did not have a delivery room with negative-pressure equipment, vaginal delivery was not possible, and a cesarean section was performed.

ii) Operating room and staff equipment

Although it is difficult to prevent infection completely, strict infection-control measures are required[24]. We used a negative pressure-controlled operating room for the cesarean sections, and the staff used Level 3 personal protective equipment (PPE) with N95 masks, face shields, double gloves, full-body gowns, and shoe covers. (Figure 1) None of the operating room staff, including the anesthesiologist, were infected with COVID-19 due to patient care.

iii) General versus regional anesthesia

Regarding the anesthesia method during the cesarean section, it has been reported that airway management by tracheal intubation during general anesthesia may generate aerosols at the time of intubation and extubation, causing virus spread[5,20]. Therefore, spinal anesthesia is recommended for cesarean section anesthesia management rather than general anesthesia. Although there have been many reports of cesarean delivery in pregnant women with COVID-19, spinal or epidural anesthesia is a common choice[2,12,16,17]. We followed this recommendation and chose spinal anesthesia.. However, it has been reported that platelet counts may decrease during the course of COVID-19 infection[7,19,25]. Therefore, when performing spinal anesthesia, it is essential to confirm that the platelet count is ≥ 70,000/μL by a preoperative blood test[11].

iv) Epidural anesthesia

Epidural anesthesia was not used for several reasons. First, anticoagulant therapy was used for the prevention of thrombosis after surgery. In the three reported cases, preoperative D-dimer levels were elevated, and postoperative anticoagulation therapy was planned. COVID-19 is associated with coagulopathy such as disseminated intravascular coagulation and thrombotic microangiopathy[18]. Typical findings of coagulation abnormalities in COVID-19 patients include increased D-dimer concentration, a relatively modest decrease in platelet count, and prolonged prothrombin time[25]. In addition to the tendency for perinatal hypercoagulation, even in normal pregnancies, COVID-19 tends to cause thrombosis. Second, the ward for postoperative management was an isolated ward for COVID-19 infection, which could delay the detection of complications of epidural anesthesia because of unfamiliarity by the clinical staff. In addition, restricted access to the COVID-19 infection isolation ward could delay anesthesiologist consultation in the event of epidural anesthesia-related complications, such as postdural puncture headache and epidural hematoma.

v) Postoperative analgesia

For post-cesarean section analgesia, morphine was added to spinal anesthesia in addition to epidural anesthesia. The use of opioids for postoperative analgesia may result in hypoxemia owing to respiratory depression. Particular attention needs to be paid to the rapid progression of hypoxemia in patients with COVID-19. When fentanyl is administered intrathecally for subarachnoid administration of opioids, the non-ionized components of fentanyl are rapidly transferred to the spinal cord. In general, respiratory depression occurs within the first 30 min after drug administration; hence, there is little need to be aware of respiratory depression for a long duration after surgery[13]. On the other hand, the incidence of respiratory depression after administration of morphine following spinal anesthesia is as low as 0–0.9%, but some patients require naloxone[1]. In addition, morphine administration following spinal anesthesia is effective 12–24 hours after surgery; therefore, owing to the unpredictability of respiratory depression, monitoring needs to be performed for a long time after surgery[6]. Morphine by IV PCA was chosen, which was

the most familiar analgesic method for the postoperative management ward staff. The administration of morphine via IV PCA after cesarean section poses a problem with regard to opioid transfer through milk[9]. However, in the case of pregnant women with COVID-19, there is a risk that the infection will be transmitted from mother to child after delivery; hence, the mother and baby are usually isolated after delivery until the mother's PCR test is confirmed to be negative. Therefore, because breastfeeding is not performed after surgery, the problem of transferring opioids used for postoperative analgesia through milk is resolved. Based on these facts, we concluded that morphine IV PCA was safer than subarachnoid administration of morphine, which may cause unpredictable respiratory depression, and postoperative analgesia with IV PCA was administered.

vi) Conclusion

In conclusion, spinal anesthesia, rather than general anesthesia, is recommended for cesarean sections in pregnant women with COVID-19 infection. In addition to the risk of thrombosis, it is necessary to manage anesthesia in pregnant women infected with COVID-19 while considering accessibility to the ward for postoperative management and familiarity of ward staff.

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Declaration of interest

none

Glossary of Terms

COVID-19: coronavirus disease 2019; IV PCA: intravenous patient-controlled analgesia; POD: postoperative day; PPE: personal protective equipment

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