

Original Research Article

Anaesthetic management in COVID-19 parturients scheduled for caesarean delivery - a comparison with non-COVID-19 parturients

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ABSTRACT

Background: Data regarding outcomes after anaesthesia in COVID-19 parturients is scanty. There is hardly any information about the length of hospital stay in COVID-19 parturients who undergo caesarean delivery (CD) as compared to non-COVID-19 parturients.

Methods: An observational study of COVID-19 parturients undergoing CD was conducted. Age and CD indication matched non COVID-19 parturients were taken as controls. The length of hospital stay along with maternal and neonatal outcomes were studied.

Results: A total of 45 COVID-19 parturients and an equal number of non-COVID-19 parturients were studied. The length of hospital stay was significantly longer in COVID-19 parturients as compared to non-COVID-19 parturients (4.3±1.6 days versus 3.3±0.6 days, p=0.02). One COVID-19 parturient developed severe disease and expired. Apart from this case, the maternal and neonatal outcomes were comparable between the two groups. Mild thrombocytopenia was seen in COVID-19 parturients. One neonate had a positive reverse transcriptase polymerase chain reaction (RT-PCR) for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) on first day of life.

Conclusions: COVID-19 parturients who undergo CD have a longer length of hospital stay than non-COVID-19 parturients. Severe disease is likely to be associated with longer length of hospital stay. Intraoperative hypotension, maternal and neonatal outcome is not significantly different between COVID-19 and non COVID-19 although mild thrombocytopenia is seen in COVID-19 parturients. While vertical transmission of SARS-CoV-2 may be possible, more data is needed regarding vertical transmission is needed.

Keywords: Caesarean section, COVID-19, Intraoperative hypotension, Length of stay, Spinal anaesthesia, Vertical transmission

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is caused due to infection by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease was first reported from Wuhan in China and was subsequently declared as a pandemic by World Health Organization (WHO).¹ The SARS-CoV-2 belongs to the same family as the severe acute respiratory syndrome corona virus

(SARS-CoV) and the Middle East respiratory syndrome coronavirus (MERS-CoV). Prior experience with these two viruses has shown that they may be associated with preterm delivery and still births in pregnant women.² Increased respiratory disorders and maternal mortality has also been associated with these infections. This predisposition to respiratory complications may be explained by physiological changes in pregnancy such as increased oxygen consumption, increased minute

ventilation with reduced functional respiratory capacity and basal atelectasis caused by the gravid uterus. These changes increase the chances of a poorer outcome during respiratory illnesses like COVID-19 pneumonia.³

The impact of COVID-19 on pregnancy is a matter of considerable debate. A few studies have reported good outcomes in pregnancy while some data suggests that a poor prognosis may be anticipated in pregnant women.^{1,4} Further, an increasing number of COVID-19 parturients require caesarean delivery (CD) for maternal or foetal indications. This is mainly due to a recommendation of a lower threshold for CD to allow for preparedness and planning for minimizing spread of infection to the treating team.⁵ In spite of a proliferation of published literature on the COVID-19 disease, data regarding CD and outcomes after anaesthesia in COVID-19 parturients is still scanty; mainly consisting of a few publications from China and a single case report from India.⁶

Since COVID-19 parturients may develop COVID-19 related complications, their length of hospital stay can be expected to be longer as shown in a study from China.⁷ However, this study included both CD as well as normal delivery and abortions. Apart from this study there is no data on length of hospital stay in COVID-19 parturients who undergo CD. Therefore, we studied the length of hospital stay in COVID-19 parturients undergoing CD and compared it to non COVID-19 parturients. We also analysed the neonatal and maternal outcomes in both these groups.

METHODS

This was an observational study conducted between April 2020 and September 2020 by the department of anaesthesia at Lady Hardinge Medical College, Delhi in North India, after approval from the institutional ethics committee. A total of 45 COVID-19 parturients who were scheduled for CD in the study period were included in the study. A written informed consent was obtained from all the subjects. As a control group an equal number of non COVID-19 parturients were included, who were matched for age and indication for CD. Patients who refused consent were excluded from the study.

A nasopharyngeal swab for reverse transcription polymerase chain reaction (RT-PCR) for SARS-CoV-2 was done for all the pregnant patients admitted to our hospital. A positive test was used to identify COVID-19 parturients while those who tested negative were considered non COVID-19 parturients. The severity of COVID-19 was graded as mild in patients without pneumonia, moderate in those with pneumonia but no hypoxia ($SpO_2 > 90\%$ on room air) and severe in those with pneumonia along with one of: respiratory rate > 30 breaths/min; severe respiratory distress or hypoxia ($SpO_2 < 90\%$ on room air). The demographic and obstetric data, indications and timing of CD, details regarding COVID-19 symptoms, stay in containment zone were noted along

with relevant laboratory investigations including complete blood count (CBC), coagulation profile, renal and liver function tests. Details of type of anaesthesia were also recorded. Intraoperative parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), respiratory rate (RR) and oxygen saturation of haemoglobin (SpO_2) were noted pre-induction (baseline), at induction of anaesthesia, then every two minutes till the ten minutes of induction and thereafter every five minutes till end of surgery. A fall of 20% in the SBP from the baseline value was used to define intraoperative hypotension. A decrease in heart rate below 60 beats per minute was considered as bradycardia. Hypotension was treated with fluids and 6mg bolus doses of injection ephedrine given intravenously. Bradycardia was treated with injection atropine 0.6 mg given intravenously. The length of hospital stay of the parturient was the primary outcome. The secondary outcomes were the maternal and neonatal outcome as well as association between severe disease and length of stay. The maternal outcome included intra-operative hypotension, postoperative nausea and vomiting (PONV), deep vein thrombosis (DVT), respiratory complications, need for oxygen therapy or tracheal intubation, intensive care unit (ICU) admission and mortality. The neonatal outcomes were prematurity, intrauterine death (IUD), Apgar score (1 min and 5 min), neonatal acidosis, neonatal ICU admission and results of neonatal RT-PCR for SARS-CoV-2.

The data was analysed with statistical package for the social sciences (SPSS, Chicago, IL, USA) version 23.0. Categorical variables were expressed as percentages while continuous variables were expressed as mean and standard deviation. The independent samples t-test was used to compare the continuous variables while Chi square test was used for comparing categorical variables. A p value of < 0.05 was considered significant.

RESULTS

A total of 45 COVID-19 parturients underwent CD between April 2020 and September 2020 and were included in this study. An equal number of matched non COVID-19 parturients were also included. The demographic data of both the groups was comparable (Table 1).

The most common co morbidities were anaemia followed by hypothyroidism, pregnancy induced hypertension and gestational diabetes mellitus. There was no significant difference in the co morbidities between the two groups. Forty percent COVID-19 parturients were asymptomatic while 60 % were symptomatic. Fever (26.7%) was the most common symptom followed by cough (13.3%) and fatigue (11.1%). Both the groups were matched for indications of CD. The common indications included fetal distress (27%), previous caesarean section (20%), cephalopelvic disproportion (16%) and breech presentation (13%). The COVID-19 group had significantly higher total leucocytes count (TLC) with a

predominance of lymphocytes and significantly lower platelet count as compared to the non COVID-19 group. All other parameters were comparable between the two groups (Table 2).

Table 1: Demographic and obstetric data.

Parameter	COVID-19 (n=45)	Non COVID-19 (n=45)
Mean age (year)	26.1±4.8	27.1±4.1
Mean height (cm)	153.5±5.4	152.5±4.6
Mean weight (kg)	58.8±9.3	57.6±10.2
Primigravida (%)	11 (24.4)	14 (31.1)
Gestational age <37 weeks (%)	7 (15.6)	2 (4.4)
Elective caesarean delivery (%)	0 (0)	37 (82.2)
Co-morbidities	18 (40.0)	17 (37.7)

Data shown as mean ±standard deviation (SD) or as n (%).

Table 2: Investigations.

Parameter	COVID-19 (n=45)	Non COVID-19 (n=45)	P value
Hemoglobin (g/dl)	10.1±1.8	10.4±1.4	0.78
TLC cells/mm ³	11421.0±4003.5*	8316.3±3403.8*	0.001
DLC (%)	P58 L38 M3 E 1	P 69 L 28 M 2 E 1	---
Platelet count (lakhs/mm ³)	1.39±0.47*	1.82±0.62*	0.02
Sodium (mEq/l)	137.8±2.5	138.2±2.1	0.85
Potassium (mEq/l)	3.9±0.3	4.3±0.5	0.65
Blood urea (mg/dl)	19.9±11.4	20.3±10.2	0.42
S. creatinine (mg/dl)	0.60±0.18	0.4±0.29	0.49
T. bilirubin (mg/dl)	0.56±0.52	0.63±0.41	0.43
Serum glutamic-oxaloacetic transaminase (IU/l)	38.8±40.8	40.3±36.3	0.15
Serum glutamate pyruvate transaminase (IU/l)	38.8±41.9	37.9±39.2	0.31
Alkaline phosphatase (U/l)	225.7±10.1	229.3±104.2	0.20

Data shown as mean±SD or as n (%); * indicates pairs with significant difference with p<0.05

Three cases from the COVID-19 group required general anaesthesia (GA) - two for ante partum haemorrhage and one for severe anaemia and thrombocytopenia while two patients from non COVID-19 group received GA for ante partum haemorrhage. In those who received regional

anaesthesia, the mean dose of drug (0.5% bupivacaine heavy) given was 1.84 ml with a mean level of T4 achieved in both the groups. Intraoperative hypotension was seen in 46.7% of the patients in the COVID-19 and 42.2 % in the non COVID-19 group. The intraoperative HR, intraoperative SBP and DBP were similar in both groups (Figure 1 and 2).

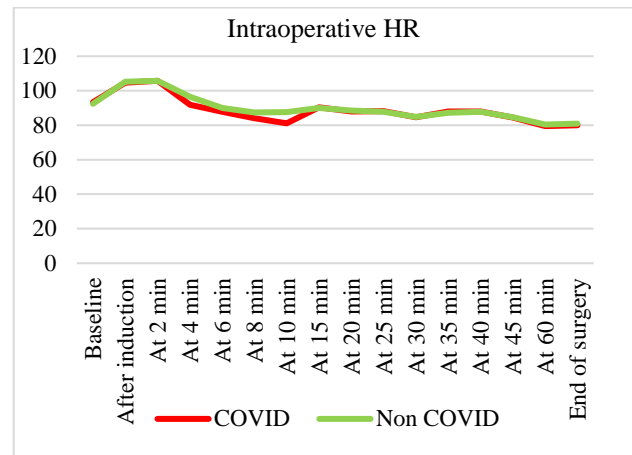


Figure 1: Intra-operative heart rate in COVID-19 and non COVID-19 parturients.

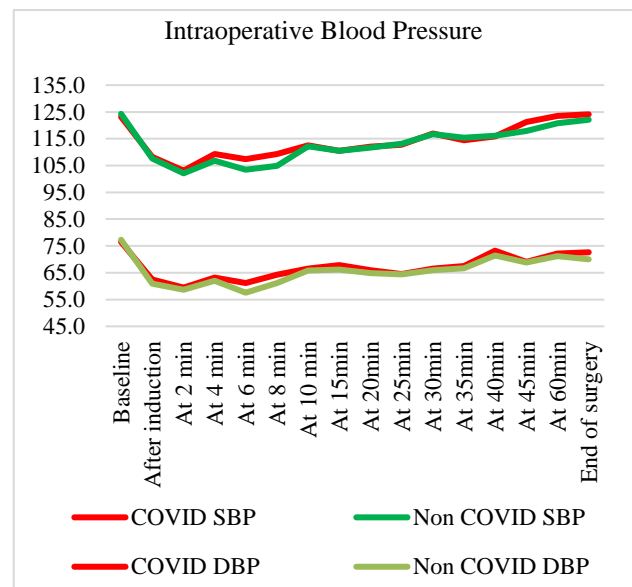


Figure 2: Intra-operative systolic and diastolic blood pressure in COVID-19 and non-COVID-19 parturients.

The length of stay in COVID-19 parturients was significantly longer than that in non-COVID-19 parturients (Table 3).

One COVID-19 parturient with preeclampsia and anemia had an uneventful CD but developed respiratory distress on postoperative day 3. She was admitted to the ICU as she developed acute respiratory distress syndrome and septic shock. Despite all efforts, she succumbed to multiple organ

dysfunction after 10 days of hospital stay. One neonate had a positive RT PCR for SARS-CoV-2 and one was shifted to NICU, all other neonatal outcomes were comparable between the two groups (Table 4).

Table 3: Maternal outcome.

Parameters	COVID-19 (n=45)	Non COVID-19 (n=45)	P value
Length of hospital stay (days)	4.3±1.6	3.3±0.6	0.02
Intraoperative hypotension (%)	21 (46.7)	19 (42.2)	0.66
PONV (%)	19 (42.2)	18 (40.0)	0.1
Respiratory complications (%)	1 (2.2)	0	0.13
Need for oxygen (%)	3 (6.7)	1 (2.2)	0.13
Need for intubation (%)	1 (2.2)	0	0.1
ICU admission (%)	1 (2.2)	0	0.1
DVT (%)	0	0	--
Mortality (%)	1 (2.2)	0	0.1

Data shown as mean ± SD or as n (%).

Two COVID-19 positive mothers had lactational failure and formula feeding was instituted for their neonates. Other maternal outcomes were comparable between the two groups except for the single mortality mentioned above.

Table 4: Neonatal outcome.

Parameter	COVID-19 (n=45)	Non COVID-19 (n=45)	P value
IUD	Nil	Nil	--
Prematurity (%)	8 (17.7)	7 (15.5)	0.74
APGAR 1 min	8 (5-9)	9 (6-9)	0.69
APGAR 5 min	9 (7-9)	9 (8-9)	0.9
Neonatal acidosis	Nil	Nil	--
NICU admission (%)	1 (2.2)	Nil	--
Mortality	Nil	Nil	--
Positive RT-PCR (%)	1 (2.2)	N/A	--

Data expressed as n (%) or median (range)

DISCUSSION

In this study we observed that the COVID-19 parturients had a significantly longer length of hospital stay as compared to non-COVID-19 parturients. This is probably the first study from India which reports the length of hospital stay in COVID-19 parturients undergoing CD. Apart from the one COVID-19 parturient who succumbed

to severe disease, the other maternal and neonatal outcomes were comparable between the two groups.

The length of hospital stay in COVID-19 parturient was longer because of several reasons. In April 2020, the Government regulations mandated the documentation of two negative RT-PCRs for SARS-Cov-2 prior to discharge. This led to additional delay in the discharge of these patients despite the absence of any other medical complication. After April 2020, patients without severe disease could be discharged with advice for home isolation. All the COVID-19 parturients had mild disease except one who developed severe disease and had a prolonged hospital stay which also contributed to the increased mean length of hospital stay. She underwent an uneventful CD under spinal anaesthesia (SA) but eventually succumbed to multiple organ dysfunction on postoperative day 10. This illustrates that severe disease was associated with longer length of hospital stay. However, on performing a subgroup analysis after excluding this one patient who did not survive, the mean length of hospital stay was 4.1±1.1 days; this was still significantly longer than the non COVID-19 parturients. The patients who undergo CD at our center are usually discharged after a minimum 72-hour length of hospital stay. Xu et al have reported length of stay in COVID-19 parturients as 10.62±4.77 days.⁷ The longer length of stay in their study may also be attributable to their criteria of two negative tests before discharge for all patients.

Regarding the clinical features of COVID-19, we found fever to be the most common symptom followed by cough and fatigue. Our findings resemble other case series from China where fever was the most common symptom, seen in 29-45% of cases followed by cough in 27-42%.^{4,8} In a study in Hispanic population of COVID-19 parturients, the prevalence of symptoms was higher but fever and cough continued to be the most common presentations.⁹ We observed mild thrombocytopenia in COVID-19 parturients which though statistically significant, was not clinically significant. Mild thrombocytopenia was reported in one-third of Chinese pregnant women who had COVID-19 and severe thrombocytopenia was associated with a worse prognosis.¹⁰ Considering these findings, it may be prudent to order platelet count in all COVID-19 parturients prior to considering spinal anaesthesia (SA) as the anaesthetic modality. We also observed a significantly higher TLC in the COVID-19 group although the mean TLC in both the groups was within the normal range. Previous reports have shown that both leucocytosis and leucopenia can occur in COVID-19 parturients although majority of them have a normal leucocyte count.¹³⁻¹⁵ Although viral infections are associated with reduction in TLC, pregnancy itself is associated with an increased in leucocytes which may explain our findings.

We observed good maternal outcomes comparable to other Asian populations. Xu et al and Zhong et al did not report severe pneumonia, ICU admission or mortality in any of their COVID-19 patients who underwent a CD.^{7,8}

Similarly, favourable maternal outcomes have been reported by Chen et al and Yu et al.^{4,11} However, Barbero et al reported that out of 91 pregnant COVID-19 women, 43.9% developed bilateral pneumonia, 46.2% needed hospitalization and 4 patients required ICU admission. These outcomes may be related to the hispanic ethnicity and greater prevalence of obesity in their study.⁹

Regional anaesthesia is now the widely accepted modality for CD and may be even more preferable in COVID-19 parturients as it minimizes chances of aerosolization. Further as lungs are the primary organs affected by COVID-19, general anaesthesia may worsen the prognosis especially if there is significant respiratory involvement. However, SA has several potential concerns, such as risk of exaggerated hypotension which may be worsened by coexisting myocardial involvement, COVID-19 related coagulopathy and thrombocytopenia related complications and possible risk of spread to central nervous system. Spread of infection to healthcare workers through CSF is also a potential risk. Intraoperative hypotension is a well-known phenomenon and can occur in up to 75% of patients undergoing CD under SA.¹² Chen et al reported intraoperative hypotension in 86% of COVID-19 parturients who received SA for CD.⁴ This is much higher than the incidence of 46% in our study. However, Chen et al have not mentioned the cut-off used to define hypotension and their sample size was also small.

Neonatal outcomes in our study were comparable between the COVID-19 and non COVID-19 groups. One neonate required NICU admission for low birth weight. Our findings corroborate with other studies which have not reported neonatal mortality or severe complications.^{7,13} Interestingly, one neonate had a positive RT-PCR for SARS-CoV-2. The nasal swab had been taken immediately after delivery by the neonatologist and this raises the possibility of vertical transmission. Vertical transmission has not been found in most studies.^{7,9,13,14} However, Vivanti et al have recently reported a case with evidence of vertical transmission in a primigravida with COVID-19 whose neonate has a positive RT-PCR on day one of life along with neurological manifestations.¹⁵ Although vertical transmission may not be common, neonates can acquire infection from the mother after delivery and severe pneumonia has been reported in three neonates despite strict infection control measures.¹⁶ Therefore skin to skin contact and delayed cord clamping is not advisable and not practiced at our institution also. We ensured the immediate transfer of the neonates to a cordoned off area of the operating room.

The risk of infection through breast milk is an area of continuing debate. In the initial experiences from China, breast-feeding was not recommended in neonates born to COVID-19 mothers. In one study, SARS-CoV-2 has been isolated from breast milk in three out of 46 samples.¹⁷ However, transmission of COVID-19 via breast milk has not been documented, this may be in part because testing of asymptomatic neonates receiving breast milk is not

being done extensively. In spite of the controversies, World Health Organization (WHO) promotes breastfeeding in COVID-19 mothers as long as adequate infection control measures are followed as the benefits outweigh risk.¹⁸ At our institution, expressed breast milk is preferred as a safe option in neonates born to COVID-19 parturients.

Our study has a few limitations. The sample size is relatively small when compared to international data but to the best of our knowledge, there is no larger study published from India. Further, in the initial period of the study the duration of stay was higher due to government regulations regarding discharge of COVID-19 patients. Hence this may have increased the mean length of hospital stay. Finally, most of the patients in our study had mild COVID-19. These results may not be applicable to parturients presenting with moderate or severe COVID-19. They may experience worse maternal and neonatal outcomes than observed in our study.

CONCLUSION

COVID-19 parturients who undergo CD have a longer length of hospital stay than non COVID-19 parturients. Severe disease is likely to be associated with longer length of hospital stay. Intraoperative hypotension, maternal and neonatal outcomes are not significantly different between COVID-19 and non COVID-19 although mild thrombocytopenia is seen in COVID-19 parturients. While vertical transmission of SARS-CoV-2 may be possible, more data is needed regarding this and regarding risk of infection through breast milk and CSF.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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