Original Article

Retrospective and Single-center Cohort Study to Determine Factors Affecting Perioperative Outcome in COVID Positive Women Underwent Cesarean Section

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Abstract

Aims and Objectives: The parturient physiologic state is significantly altered from non-pregnant women; COVID-19 adds more challenges in management of parturient as pregnancy increases susceptibility to respiratory complications. The aim of this study is to determine factors affecting perioperative outcome in COVID-19 positive pregnant women underwent cesarean section.

Materials and Methods: The retrospective and single-centered cohort study was carried out in the Department of Anesthesiology and Critical Care Medicine, M.L.B. M.C. a tertiary medical center in Jhansi (U.P.), in collaboration with the Department of Obstetrics and Gynecology, a total 55 patients of SARS COV-2 positive patient who underwent cesarean section were included in the study. Patient demographics and other informations were taken from the patient medical file and analyzed retrospectively.

Results: A total of 55 patients who were SARS-CoV-2 PCR tests positive were included in the study and further statistical analysis. The majority of the patient belong to 20–30-year age group (72%) and were unbooked (76.36%), the mean gestational age at delivery was 33–36 weeks (43.64%), Obesity was present in 2 (3.64%) patient, three patients were elder mother (5.45%). The majority of cesarean sections were due to fetal distress (58.18%) and were operated under spinal anesthesia (92.72%), mean arterial blood pressure was found 80–100, expect for the patient with sever disease, tachycardia was present in majority (90%) of the patient. Lymphopenia, thrombocytopenia, eosinophilia, neutrophilia, and leucopenia in general are some findings seen in most of the COVID-19 patients especially in ICU. General anesthesia given to 4 patients (7.27%), neonatal morbidity was seen as FGR (40%) and low APGAR score (80%), and need of NNU admission (80%), during the duration of study, there were 2 IUD (3.64%) and 4 maternal mortalities (7.27%) observed. Four anesthesia resident became positive involved in these operations.

Conclusion: COVID-19 is now considered more as a systemic infection rather than the common flu. Beside severe disease; obesity, elder maternal age, and primiparity were independent risk factors for poor outcome. The risk of transmission can be reduced with appropriate PPE and regional anesthesia.

Key words: Cesarean section, COVID-19, Pregnancy, SARS-COV-2

INTRODUCTION

SARS-CoV-2 causing COVID-19 disease spread all over the world, the World Health Organization (WHO) declares this easily spreading disease as global pandemic on March 11, 2020[1], as of current worldwide status while writing this paper, there were more than 462,410,883 coronavirus confirmed cases and approximately 6,075,665 deaths were reported, in which India contributing about 42,998,938 confirmed cases and 519,103 total deaths as per data updated by WHO (*covid19.who.int/table*).

Perioperative management of parturient has always been considered challenging regarding difficult airways and pulmonary complications (decreased FRC and reactive airway) due to relatively depressed immunity and several

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cardiopulmonary changes during pregnancy[2]. Pregnant women are more prone to morbidity and mortality due to COVID-19 infection in comparison to non-pregnant female. Hematologic profiles depend on the severity of the disease. The major pregnancy-related hemodynamic changes include increased cardiac output, increase in blood volume, and decreased systemic vascular resistance and blood pressure[3]. A significant number of deaths due to COVID-19 infection can be attributed to cytokine storm and cytokine release syndrome. COVID-19 can exacerbate thrombophilia, due to a rise in D-dimer levels and longer PT[4,5].

In this study, our aim is to evaluate the demographic data of COVID-19 patients underwent cesarean section, our anesthesia technique, complications, and neonatal outcome.

MATERIALS AND METHODS

Study Design and Ethical Statement
The retrospective and single-centered cohort study was carried out in the Department of Anesthesiology and Critical Care Medicine, M.L.B. M.C. a tertiary medical center in Jhansi (U.P.), in collaboration with the Department of Obstetrics and Gynecology, data collected from patient medical file, operation theater register, and labor room register, after the approval of Institutional Ethical Committee.

A total 55 patients of SARS-CoV-2 positive patient who underwent cesarean section were included in the study. Patients who were clinically suspected (clinical symptoms or travel history), but tested negative for COVID-19 were excluded from the study. In our institute's protocol, we tested every patient for RAPID ANTIGEN, TRUNAAT, and RTPCR before taking emergency or routine cesarean section. Patient demographics and other informations were taken from the patient medical file and analyzed retrospectively.

Inclusion Criteria
SARS-CoV-2 positive pregnant women of reproductive age group between 18 and 45 years belonging to ASA Grade I–IV, underwent cesarean section during COVID pandemic were included in the study.

Exclusion criteria
Records not trackable were excluded from the study.

Statistical analysis was performed with SPSS software 21 windows (statistical package for the social sciences). Categorical data were expressed in number (%), while continues data were expressed in mean (SD) percentage. Spearmen's correlation test was used for correlation analysis. The value <0.05 was considered statistically significant.

Consort Diagram
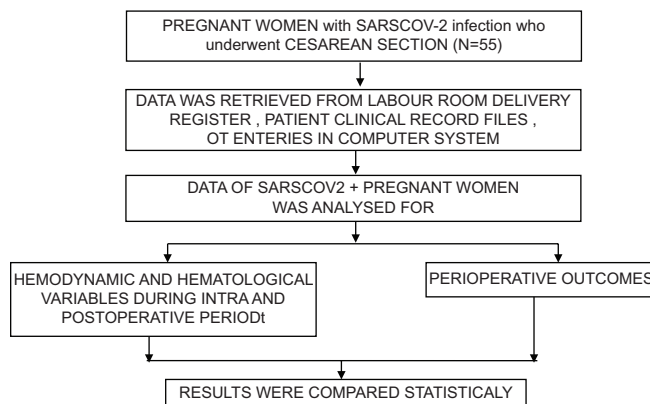
RESULTS

A total of 55 patients who were positive SARS-CoV-2 RTPCR were included in the study and further statistical analysis done. The majority of the patient belong to 20–30-year age group (72%) with mean age of studied population that was 29.65 ± 5.6 years and were electively operated for cesarean (76.36%), the mean gestational age at delivery was 35.36 ± 3.26 weeks. Mean BMI reported was 19 ± 3.25, with obesity in 2 (3.64%) patient, with, three patients were elder mother (5.45%). About 26 (50.90%) of the all patients not have any chronic medical illness, while pneumonia, anemia, and chronic hypertension gestational diabetes were the most common medical illness. The most of the patient belong to the ASA Grade II, but there were four patients belonging to ASA Grade IV, while two patients were already in mechanical ventilation support and were shifted to operation theatre with all precautions, the demographic distribution along with other baseline data is given in Table 1. Forty-two (76.36%) cases were recorded as emergency cases, the majority of cesarean sections were due to fetal distress (58.18%) and were operated under spinal anesthesia (92.72%).

The patient was preloaded with balanced crystalloid, ringer lactate 500 ml, before applying spinal, the subarachnoid block was performed by injecting 10 mg of 0.5% bupivacaine with 25G quincke spinal needle at L3-4 intervertibral space, mean arterial blood pressure was found 80–100 mmHg, while hypotension in 13 (25.49%) patient was recovered using injection ephedrine 7.5 ± 6.5 mg intravenously, there was no episode of vomiting, shivering, and failed spinal block in any of the patients. Expect for the patient with sever disease, tachycardia was present in majority (90%) of the patient. SpO_2 was significantly less for 6 (10.90%) patients. Lymphopenia, thrombocytopenia, eosinophilia, neutrophilia, and leukopenia in general are some findings seen in most of the COVID-19 patients especially in ICU as shown in Table 2. Although the majority of covid infected pregnant females were aymptomatic, amongst symptomatic the most frequent

symptom was cough followed by myalgia, sorethroat and headache. Oxygen therapy was required by as high as 14.54% of covid positive pregnant women as shown in Table 3.

42(76.36%) cases were recorded as emergency cases, Majority of caesarean sections were due to fetal distress (58.18%) and were operated under Spinal Anesthesia (92.72%), General Anesthesia given to only 4 (7.27%) patient shown in Table 4 in which two patients who were already on mechanical ventilation, and shifted to the operation theatre from ICU, one patient had platelet count 65000/mm³, and one patient was unstable with severe pneumonia, in these four patients,

Table 1: Distribution according to the demographics and pre-operative data

Characteristics	*n*=55
Age (years), mean±SD	29.65±5.6
Gestational age, week, mean±SD	37.36±3.26
Basal metabolic rate (BMI)	19±3.25
Parity, *n* (%)	
Nulliparity	24 (43.63)
Multiparity	31 (56.62)
Medical history, *n* (%)	
No medical history	26 (50.90)
Pneumonia	12 (21.81)
Placental abnormality	5 (9.09)
Preeclampsia	3 (5.45)
Hypertension	4 (7.26)
Diabetes mellitus	2 (3.64)
Gestational diabetes mellitus	2 (03.63)
Thyroid disorder	1 (1.81)
Thrombophilia	1 (1.81)
Anemia	20 (36.36)
ASA grading, *n* (%)	
II	41 (74.54)
III	10 (18.18)
IV	4 (07.27)
Pulse oximetry, *n* (%)	
80	6 (10.90)
80–90	14 (25.45)
90–100	35 (63.63)

ASA: American Society of Anesthesiologists

Table 2: Distribution according to the laboratory variations

Hematological markers before surgery	Mean (*n*=55)±SD
Hemoglobin, g/dl	10.26±1.82
Platelet, mcl	206±62
Total leukocyte counts, cmm³	5600±562.23
Aspartate aminotransferase, u/l	32±22.32
Alanine aminotransferase, u/l	27±23.12
Serum creatinine, g/dl	0.58±0.42
CRP	2.16±2.44
Normal Range – (lower than 1.0 mg/dl)	
Serum Ferritin	53.66±78.02
Normal Range – (11–150 ng/mL)	
D-dimer	3.00±2.24
Normal Range – (<5 ng/mL)	
Fibrinogen	456±144
Normal Range – (200–400 mg/dl)	

there was no need to use injection ephedrine, In general anesthesia, we followed rapid sequence intubation using injection propofol and injection succinylcholine as induction agents, inj. Atracurium/oxygen/N_2O used as maintenance and injection fentanyl and sevoflurane was taken after cord clamping, only patient with thrombocytopenia was extubated with injection myopyrolate and shifted to ICU, while other three were shifted back to ICU on mechanical ventilation.

The requirement for post-operative ICU follow-up was 6 (10.90%) in all COVID-19 positive patients, 33.33% (6/18) in symptomatic patients and 50% (6/12) in pneumonia patients. Four maternal mortalities (7.27%) observed, while mortality rate in symptomatic patients was 22.22% (4/18) and 44.44% (4/9) in pneumonia patients.

The mean length of hospital stay was 7.92 ± 16.88 days. Two patient's length of hospital stay was longer than the other, 26–30 days, hemoglobin level has a negative correlation with length of hospital stay (r = −0.263 and $P = 0.05$), fibrinogen levels (r = −0.322 and $P = 0.009$), and the weeks of gestation (r = −0.306 and $P = 0.036$), there was positive correlation with age (r = 0.286 and $P = 0.0043$), there was no correlation between C-reactive protein, thrombocyte, lymphocyte, D-dimer, and ferritin level with length of hospital stay.

Neonatal morbidity was seen as FGR (40%), low APGAR score (50%), and need of NNU admission (26.42%), during the duration of study, there were 2 IUD (3.64%) as shown in Table 5. All two newborns are tested positive for COVID-19 with nasopharyngeal swab. All cesarean section was performed in operation room, reserved for COVID-19 patients, the whole team was equipped with Level-3 personal protective kit (PPE). Patients were transferred to the COVID-19 Wards or COVID ICU. Two health-care professional from anesthesia team and two health-care professional from surgery became positive involved in these operations.

DISCUSSION

COVID-19 is now considered more as a systemic infection rather than the common flu. Beside severe disease; obesity, elder maternal age, and primiparity were independent risk factors for poor outcome.

In this retrospective and observational study, we evaluated 55 COVID-19 positive parturient who underwent cesarean section during the epidemic period in our tertiary teaching institute, It appeared that COVID-19 does not causes impaired hemodynamic variables of patients. It is recommended to perform neura-axial anesthesia for COVID-19 positive patients when there is no

Table 3: Distribution according to the sign and symptoms of COVID-19 positive patients

Symptoms	Number *n* (%)
Asymptomatic	37 (67.27)
Symptomatic	18 (32.27)
Fever	6 (10.90)
Myalgia	8 (14.54)
Sore throat	6 (10.90)
Cough	9 (16.36)
Shortness of breath	5 (09.09)
Tiredness	5 (09.09)
Headache	6 (10.90)
Loss of taste and smell	4 (07.27)
Oxygen therapy	8 (14.54)

Table 4: Distribution according to the operative data and perioperative events

Characteristics	*n* (%)
Emergency	42 (76.36)
Elective	13 (23.63)
Mean arterial pressure	86.62±8.65
Heart rate	92±9.65
Indication for cesarean delivery	
Scar tenderness	12 (21.82)
Fetal distress	32 (58.18)
Obstructed labor	4 (07.27)
Cephalopelvic disproportion	3 (05.45)
Non-progress of labor	4 (07.27)
Type of anesthesia	
Spinal	51 (92.72)
General	4 (07.27)
Duration of surgery (minutes)	68±18.6
Blood loss (mL)	682±199.6
Fluid given (mL)	2172±642.2

Table 5: Distribution according to the neonatal outcome

Neonatal outcome	Number (%)
Neonatal complications	
FGR	22 (40)
Oligohydramnios	32 (58.18)
Preterm	2 (3.64)
IUD	2 (3.64)
Gender	
M	24 (43.63)
F	31 (56.36)
APGAR	
At birth	
≤7	28 (50.90)
8–10	27 (49)
At 5 min	
≤7	20 (36.36)
8–10	35 (63.63)
Birth weight	
Normal	35 (63.63)
Low	17 (30.90)
Very low	2 (3.63)
Extremely low	1 (1.82)
Umbilical cord pH	
7.20–7.38	52 (94.94)
<7.20	3 (5.45)
NICU admission	14 (26.42)

contraindication.[6] Chen *et al*.[7] applied general anesthesia to three of 17 COVID-19 positive patients undergoing cesarean section and the remaining 14 patients received epidural anesthesia. While no hypotension was observed in the general anesthesia group; the hypotension rate was as high as 86% in the epidural group.[7] In this study, four of 55 patients were given general anesthesia, use of ephedrine was not required in patient who underwent general anesthesia. The rate of spinal anesthesia was 92.72% and requirement of ephedrine was 25.49%. In the study of Chen *et al*.,[7] all of the patients undergoing general anesthesia were emergency patients while the epidural group consisted of elective patients. In our study, 42 (76.36%) of the cases were emergency patients.

The previous studies show that the most obstetric patients were asymptomatic at the time of admission or had COVID-19-like symptoms (fatigue, muscle pain, shortness of breath, congestion, etc.), which can be easily confused with common pregnancy symptoms. In this study, 67.27% of our COVID-19 positive patients included were asymptomatic.

In our study, maternal mortalities rate was 7.27%, while mortality rate in symptomatic patients was 22.22% (4/18) and 44.44% (4/9) in pneumonia patients. Juan *et al*.[8] reported seven maternal deaths in a review of 324 pregnant women with COVID-19 infection and reported the frequency of serious pneumonia in pregnant women as 0–14%. In the study of Chen *et al*.,[7] one of the first articles on pregnant women at the beginning of the pandemic, all patients had chest tomography scans, in which all were compatible with pneumonia. In our study, rate of pneumonia was 21.81%, in all patients, while in symptomatic patients, it was 66%.

Chen *et al*.[7] emphasized that 14 patients had a hospital stay of 6–13 days. In our study, the length of hospital stay was found as 7.92 ± 16.88 days. In our study, we found a significant negative correlation with hemoglobin levels, fibrinogen levels, and gestational week for the length of hospital stay and a significant positive correlation with age.

Schwartz[9] reported that comorbid diseases (pre-eclampsia, pregnancy-induced hypertension, gestational diabetes, uterine atony, etc.) do not pose a risk for intrauterine transmission SARS-CoV-2 to the fetus. They also found no association between 30 and 40 weeks of gestation and mother-to-child transmission. Juan *et al*.[7] reported four intrauterine fetal deaths and two neonatal deaths in their systematic review. Two COVID-19 infections and no congenital anomaly were detected in any of our newborns. Of these newborns, 26.42% needed neonatal intensive care.

Lucas *et al*.[10] obstetric anesthesia experiences in COVID-19 reported that the most of the transmissions could be prevented by wearing and removing PPE correctly. Furthermore, in our study, all anesthetists used Level-3 PPE and two of them became infected afterward. The lower incident of infection in anesthetists performing cesarean section indicates that the risk of transmission can be reduced with appropriate PPE and regional anesthesia.

There is currently no evidence for intrauterine infection caused by vertical transmission in women who develop COVID-19 pneumonia in late pregnancy[11],also in our study only 2 newborns were tested positive for covid-19 with nasopharyngeal swab.

Karaca *et al*[12] General anesthesia was applied to only three patients (4.9%), while spinal anesthesia was administered to the remaining 58 patients (95.1%). Forty-one (67.2%) parturients were asymptomatic. While the rate of pneumonia in symptomatic patients was 45% (9/20), the pneumonia incidence among all SARS-CoV-2 PCR (+) parturients was 14% (9/ 61).They concluded that Spinal anesthesia was safely and effectively administered in COVID-19 parturients, especially in patients with pneumonia, also in our study, majority of caesarean sections were due to fetal distress (58.18%) and were operated under Spinal Anesthesia (92.72%), General Anesthesia given to only 4 (7.27%). 67.27% of the parturients were asymptomatic, while the rate of pneumonia in parturients was 21.81%, majority were operated under spinal anesthesia. Karaca et al observed that overall mortality rate was 1.6% (1/61) among parturients with COVID-19 undergoing cesarean section, while it was 11.1% (1/9) in patients with pneumonia. However in our study 4 maternal mortalities (7.27%) observed, while mortality rate in symptomatic patients was 22.22%(4/18) and 44.44%(4/9) in pneumonia patients.

Limitations
It was a single-center study, we could include more centers for better interpretation of data, RTPCR testing limitations also played important role in undervaluation of COVID-19 cases. The treatment guidelines were also evolving; hence, change in treatment guidelines has an impact on the length of hospital stays, as home treatment implemented as the pandemic progressed.

There are very literature available about COVID-19 patient, our study oriented toward the anesthesia experiences in COVID-19 positive parturient; hence, further studies needed for understanding this disease.

CONCLUSION

COVID-19 is now considered more as a systemic infection rather than the common flu. Beside severe disease; obesity, elder maternal age, and primiparity were independent risk factors for poor outcome. The risk of transmission can be reduced with appropriate PPE and regional anesthesia.

AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Validation and Supervision, Dr. Shivali Pandey; Investigation, Data Curation, Writing-Original Draft Preparation, Dr. Anil Kumar, review and editing Dr. Yamuna.

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