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*Original Article*

# Perioperative Outcome of COVID-19-Positive Parturient Posted for Cesarean Section—Our Experience in a Tertiary Care Hospital in Northern India

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## ABSTRACT

**Introduction:** There is insufficient data regarding the severity of coronavirus disease 2019 (COVID-19) infections in pregnant women. This study assessed the outcome of COVID-19-positive parturient after cesarean section, correlation of maternal mortality with COVID-19 severity, association of comorbid parturients with severe COVID-19, and number of patients requiring general anesthesia.

**Materials and Methods:** This single-center, retrospective observational study was performed on reverse transcriptase polymerase chain reaction confirmed COVID-19-positive 89 parturients posted for elective or emergency cesarean section. Data was collected from medical records of our hospital regarding COVID-19 severity, maternal mortality, need for admission in intensive care unit, gestational age, maternal comorbidities, indication for cesarean section, type of anesthesia, duration of surgery, neonatal birth weight, neonatal mortality, Appearance, Pulse, Grimace, Activity and Respiration (APGAR) score, and neonatal intensive care unit (NICU) admission. Assessment of maternal outcome was the primary objective. Secondary objectives of this study were to correlate maternal outcome with COVID-19 severity, to find association of comorbid parturients with severe COVID-19 and to estimate number of patients requiring general anesthesia.

**Results:** Out of 89 patients, 79 patients had mild COVID-19 disease were on room air and 6 patients required preoperative oxygen supplementation, and 4 patients diagnosed to have severe COVID-19 pneumonia were on mechanical ventilator preoperatively. Four cases were operated under general anesthesia and remaining 85 parturients were operated under regional anesthesia. Out of four parturients with severe COVID-19 pneumonia, three patients did not survive in postoperative period due to refractory hypoxemia. In eight patients, spinal anesthesia was repeated due to inadequate effect. Fourteen neonates (16.09%) required NICU stay after cesarean delivery.

**Conclusions:** Parturients with severe COVID-19 disease had higher mortality. No statistically significant association was found between number of comorbidities and severity of COVID-19. The results of this study will guide us regarding further management and prognostication of COVID-19-positive parturients posted for cesarean section.

**Keywords:** COVID-19, Parturients, Severity, Comorbidities

## INTRODUCTION

On March 11, 2020, the coronavirus disease 2019 (COVID-19) outbreak was declared a pandemic by the World Health Organization (WHO). All elective surgeries were stopped and resources were diverted to provide support for critically ill COVID-19 patients.[1] However, anesthesia

services had to be continued for obstetric patients for obvious reasons. At present, there is insufficient data with regard to severity of disease in COVID-19-positive parturients.[2] Some of the current literatures suggest that pregnancy may worsen the course of COVID-19 infection when compared with nonpregnant women of the same age.[3] Other viral diseases in pregnancy such as H1N1 influenza and severe acute respiratory syndrome have been associated with severe respiratory compromise in pregnancy.[4] Therefore, we conducted this study to assess the outcome of COVID-19-positive parturient after cesarean section. Results of this study can guide us regarding further management and prognostication of COVID-19-positive parturients.

### Research hypothesis

Hypothesis was formulated that there is no association between number of comorbidities and COVID-19 severity and there is no association between COVID-19 severity and maternal outcome.

### Aim and objectives

- The aim of this study was to assess the outcome of COVID-19-positive parturient after cesarean section, while following were the objectives: Primary objective—Maternal outcome, in terms of maternal mortality and need for intensive care unit (ICU) admission. Secondary objectives—Correlation of maternal outcome with COVID-19 severity, association of comorbid parturients with severe COVID-19 and estimated number of patients requiring general anesthesia.

## MATERIALS AND METHODS

### Study Design

This single-center, retrospective observational study was performed from April 2020 to May 2021 in COVID-19 operation theater of a dedicated COVID-19 hospital after institutional ethics committee approval.

### Participants

This record-based study was performed on reverse transcriptase polymerase chain reaction (RT-PCR) confirmed COVID-19-positive parturient posted for elective or emergency cesarean section. Eighty-nine parturients who underwent cesarean section were included in the study. All COVID-19 suspected cases were excluded from the study.

### Data collection

Data was collected from medical records of our hospital regarding COVID-19 severity, maternal mortality, need for admission in intensive care unit, gestational age, maternal comorbidities, indication for cesarean section, type of anesthesia, duration of surgery, neonatal birth weight, neonatal mortality, APGAR score, and neonatal intensive care unit (NICU) admission in a structured proforma. In this study, patients who had hemoglobin less than 11 g% were classified as anemic[5] and degree of severity of COVID-19 was defined as per clinical management protocol of Ministry of Health and Family Welfare version 3.[6] Patients with mild disease presented with uncomplicated upper respiratory tract infection without evidence of breathlessness or hypoxia. Parturients presenting with clinical features of dyspnea and/or hypoxia, fever, cough, oxygen saturation (SpO2) less than 94% on room air (range: 90–94%), respiratory rate (RR) equal to or more than 24 per minute were categorized to have moderate disease. Parturients with clinical signs of pneumonia and one of the following: RR => 30 breaths per minute, severe respiratory distress, SpO2 less than 90% on room air were diagnosed to have severe COVID-19 pneumonia. Thrombocytopenia in pregnancy was defined as platelet count less than 1.5 lac per cubic mm.[7] Parturients with blood pressure more than 140/90 mm Hg after 20 weeks of gestation were classified as pregnancy induced hypertension.[8]

### Statistical analysis

Data was entered in Microsoft Excel Sheet and analyzed using SPSS version 25. First, normality tests like Kolmogorov-Smirnov test and Shapiro–Wilk test were applied. The data satisfied the condition of normality, so we used simple regression analysis. For quantitative data, mean and standard deviation was calculated. Qualitative data was analyzed in terms of percentages and proportions. *p*-Value less than 0.05 was considered to be statistically significant.

## RESULTS

### Patient characteristics

Eighty-nine parturients with RT-PCR confirmed COVID-19 posted for cesarean section were included in the study. Out of 89 patients, 79 patients had mild COVID-19 disease and 4 patients diagnosed to have severe COVID-19 pneumonia were on mechanical ventilator preoperatively. Six patients required preoperative oxygen supplementation, two patients were on nasal prongs with oxygen flow of 4 L per minute (L/m), two patients were on face mask preoperatively with oxygen flow of 5 to 7 L/m, and two patients were on non-rebreathing mask with oxygen flow of 10 to 15 L/m.

Patient characteristics are summarized in Table 1. The mean age of the patients was 24.39 years and mean gestation age was 38.33 weeks. Fifteen parturients (16.85%) delivered before 37 weeks of gestation. Out of 89 patients, 29 patients

**Table 1**: Perioperative characteristics of obstetric patients with COVID-19 infection baseline characteristics.

| | |
|---|---|
| Age of patient in years (mean ± SD) | 24.39 ± 3.55 years |
| Gestational age in weeks (mean ± SD) | 38.33 ± 1.90 years |
| Gestational age < 37weeks (%) | 16.85% |
| **Comorbidities (%)** | |
| Thrombocytopenia | 16.85% |
| Hypothyroidism | 5.6% |
| Hypertension | 18.0% |
| Diabetes | 5.6% |
| IHCP | 21.3% |
| HIV | 2.2% |
| Anemia | 32.6% |
| Others | 3.4% |
| **Preoperative parameters** | |
| SpO2 (Mean) | 97.76% |
| COVID-19 severity (%) | 88.8% |
| Mild | 6.7% |
| Moderate | 4.5% |
| Severe | 6.7% |
| **Preoperative oxygen therapy requirement (%)** | |
| Hb (mean ± SD) | 11.35 ± 1.63 g/dL |
| TLC (mean ± SD) | 11493 ± 3667.04 |
| Platelet count (mean ± SD) | 2.17 ± 0.81 |
| SGOT (median) IQR | 32 (IQR 25) |
| SGPT (median) IQR | 34 (IQR 24) |
| Serum bilirubin (mean ± SD) | 0.59 ± 0.19 |

Abbreviations: COVID-19, coronavirus disease 2019; Hb, hemoglobin; IHCP, intrahepatic cholestasis of pregnancy; IQR, interquartile range; SD, standard deviation; SGOT, serum glutamic-oxaloacetic transaminase; SGPT, serum glutamic-pyruvic transaminase; SpO2, oxygen saturation; TLC, total leucocyte count.

(32.6%) were anemic, 19 patients (21.3%) had intrahepatic cholestasis of pregnancy, 16 patients (18%) had pregnancy induced hypertension, and 15 patients (16.85%) had thrombocytopenia.

### Perioperative Outcome

Out of 89 parturients, 69 parturients (77.5%) underwent emergency cesarean section and 20 parturients (22.5%) underwent elective cesarean section. Most common indication for cesarean section was fetal distress(47 parturients; 52.80%). Other common indications were previous cesarean section (24 parturients; 26.9%) and meconium-stained liquor (17 parturients; 19.10%).

Four cases were operated under general anesthesia and remaining 85 parturients were operated under regional anesthesia. Parturients who were operated under general anesthesia had severe COVID-19 pneumonia and three patients were on mechanical ventilation preoperatively and one patient was intubated immediately before surgery, as she was not maintaining saturation on non-rebreathing mask.

**Table 2**: Perioperative maternal and neonatal outcome.

| Characteristics | |
|---|---|
| Maternal death (%) | 3.37% |
| IUD (%) | 2.25% |
| Patients requiring perioperative ventilation/ICU stay (%) | 4.49% |
| Parturient undergoing emergency cesarean section (%) | 77.5% |
| Parturient undergoing elective cesarean section (%) | 22.5% |
| Patients requiring repeat spinal anesthesia (%) | 9% |
| Percentage of patients operated under general anesthesia (%) | 4.49% |
| Average duration of surgery in minutes (mean ± SD) | 80.2 ± 16.15 |
| Duration of hospital stay (median/IQR) | 5 days, IQR =2 days |
| Number of neonates requiring NICU stay (%) | 16.09% |
| APGAR score 1 minute (mean ± SD) | 7.55 ± 1.46 |
| APGAR score 5 minutes (mean ± SD) | 9 ± 1.57 |
| Birth weight (mean ± SD) | 2.84 ± 0.47 |

Abbreviations: APGAR, Appearance, Pulse, Grimace, Activity and Respiration score; IQR, interquartile range; IUD, intrauterine death; NICU, neonate intensive care unit; SD, standard deviation.

All the four patients with severe COVID-19 disease required perioperative intensive care stay. Out of four parturients with severe COVID-19 pneumonia, three patients did not survive in postoperative period due to refractory hypoxemia. In eight patients, spinal anesthesia was repeated due to inadequate effect. Average duration of surgery was 80.2 minutes. Median duration of hospital stay was 5 days. Out of the 89 cesarean sections, there were two intrauterine fetal deaths and no neonatal deaths. Mean birth weight was 2.84 + 0.47 in this study. Mean APGAR score at 1 minute and 5 minute was 7.55 ± 1.46 and 9 ± 1.57, respectively. Fourteen neonates (16.09%) required NICU stay after cesarean delivery [Table 2].

Out of four patients with severe COVID-19 pneumonia, one patient did not have any comorbidity; second patient had pregnancy-induced hypertension and intrahepatic cholestasis of pregnancy; third patient had pregnancy-induced hypertension, intrahepatic cholestasis of pregnancy and hypothyroidism; fourth patient had intrahepatic cholestasis of pregnancy. In this study, we found mild correlation between COVID-19 severity and number of comorbidities in parturients ($r$-value—0.206, $r^2$—0.042, $p$-value—0.055, which is not statistically significant; [Table 3]). This means there are 4.2% chances of increase in COVID-19 severity with increase in number of comorbidities. Odds ratio of COVID-19 severity and no of comorbidites is 2.24 which also emphasizes on positive association between number of comorbidities and COVID-19 severity.

**Table 3**: Cross-tabulation between number of comorbidities and COVID-19 severity.

| COVID-19 severity | Comorbidity present | No comorbidity | Total | Odds ratio |
|---|---|---|---|---|
| Moderate and Severe | 8 | 2 | 10 | 2.24 |
| Mild | 51 | 28 | 79 | |
| Total | 58 | 30 | 89 | |

Abbreviation: COVID-19, coronavirus disease 2019.

**Table 4**: Cross-tabulation between outcomes and COVID-19 severity.

| Maternal Mortality | | | | |
|---|---|---|---|---|
| **COVID-19 severity** | **Yes** | **No** | **Total** | **Odds ratio** |
| Moderate and Severe | 3 | 7 | 10 | 19.25 |
| Mild | 0 | 79 | 79 | |
| Total | 3 | 85 | 89 | |

Abbreviation: COVID-19, coronavirus disease 2019.

However, there was a strong correlation between COVID-19 severity and maternal mortality ($r$-value—0.730, $r^2$—0.532, $p$-value 0.01, which is statistically significant; [Table 4]). This means there are 53% chances of increase in adverse outcomes with increase in COVID-19 severity. Also, odds ratio of COVID-19 severity and maternal outcome is19.25, which strongly emphasizes on increase in maternal mortality with increase in COVID-19 severity.

## DISCUSSION

We hereby report 89 COVID-19 (RT-PCR)-positive parturients posted for cesarean section. Parturients were categorized to have mild, moderate, severe disease.[6] Seventy-nine parturients (88.7%) had mild COVID-19 disease, six patients (6.74%) had symptoms of moderate disease, and 4 patients (4.5%) had severe COVID-19 pneumonia requiring mechanical ventilation. In a joint report of WHO–China of 147 cases in pregnancy, 8% of women were suffering from severe respiratory disease and 1% required mechanical ventilation.[9] In a report based on 116 cases of COVID-19 in pregnant women, 6.9% pregnant women reported severe COVID-19 pneumonia.[10] In another study from China, 8% incidence of severe COVID-19 disease was reported in pregnant women. Higher incidence of severe disease can be explained by different criteria used for categorization and they included pregnant women in all trimesters. In this study, a total of 109 of 118 women (92%) had mild disease, and 9 (8%) had severe disease (hypoxemia), 1 of whom received noninvasive mechanical ventilation (critical disease). Severe disease developed in six of the nine women after delivery.[11]

In our study, we found a maternal mortality of 3.37%. There was no mortality in patients with mild and moderate disease; however, in patients with severe disease, three out of four patients (75%) succumbed to the disease. There was significant association between severity of COVID-19 pneumonia and maternal mortality [Table 4]. In a recent systematic review and meta-analysis of 11,758 pregnant women in 117 studies, maternal mortality was 1.3%. It was observed in this review that maternal mortality was low in high-income group countries (0.19%) and it was 8.51% in middle-income countries. As disease severity was not reported in 1,125 subjects, it was likely that a greater number of patients were having mild-to-moderate disease.[12] These can explain variation in mortality rate from our study. In a case series to describe maternal and perinatal outcomes and death of pregnant women with severe COVID-19, at the time of reporting (April, 2020) seven out of nine had died, one remained critically ill, and one recovered after prolonged hospitalization. They included only severe cases in the case series and found a higher mortality and this is in accordance with our study.[13]

In this study, we could not find statistically significant association between severity of COVID-19 pneumonia and number of comorbidities in pregnant women. Hantoushzadeh *et al.*[13] reported a case series of nine pregnant women diagnosed with severe COVID-19 in their second or third trimester. They reported seven deaths; one patient remained critically ill and ventilator-dependent, and one recovered after prolonged hospitalization. Five of the women who died were over 35, older than current study population. Most of the women in the study had comorbidities such as obesity, gestational diabetes, and hypothyroidism. All deaths were due to severe COVID-19. In a systematic review, Juan *et al.*[2] did not report higher incidence of gestational diabetes and hypertensive disorders in COVID-19-positive parturients as compared with pregnant women without COVID-19. In a report based on 116 cases of COVID-19-positive pregnant women, there were 7.8% parturients with gestational diabetes, 3.4% with hypertensive disorders and these complications were unrelated to COVID-19 pneumonia as found in our study.[10]

About 77.5% parturients underwent emergency cesarean section in our study and most common indication for cesarean section was fetal distress (52.8%). Other common indications were previous cesarean section (26.9%) and meconium-stained liquor (19.10%). Zhang *et al.*[14] studied anesthetic management and clinical outcomes of parturient with COVID-19 in a multicenter, retrospective, propensity score matched cohort study and they noticed that incidence of emergency cesarean section was 68.5%.

Majority of the patient in our study had mild-to-moderate disease (95.5%) and were operated under spinal anesthesia.

Intrathecal anesthesia was the technique of choice in our study as in non-COVID-19 cesarean sections, because it avoids aerosol exposure to health care personnel.[9]

COVID-19 parturients with hypoxia and decreased functional residual capacity are at risk of worsening of hypoxemia due to general anesthesia-induced atelectasis; thus, they are more likely to require postoperative ventilator support.[4] However, more than one attempt of spinal had to be made in initial few cases due to obscured vision and limited tactile sensation because of personal protective equipment. Approximately 9% of parturients required repeat spinal anesthesia. In our study, four patients with severe COVID-19 pneumonia had to be operated under general anesthesia and required postoperative mechanical ventilator support in ICU.

It was hypothesized in the beginning that there is no association between COVID-19 severity and maternal mortality; however, *p*-value of 0.01 and odds ratio 19.25 suggest strong, statistically significant association between the two; hence, this hypothesis stands rejected. Also, hypothesis was made that there is no association between number of comorbidities and COVID-19 severity, but *p*-value of 0.055 and odds ratio of 2.24 suggest mild, statistically nonsignificant association between the two which can be attributed to the small sample size of the study, and we need a bigger sample size to reach to a definitive conclusion. So, this is pertinent limitation of the study.

In our study, there were 16.85% preterm births; however, in a study by Yan *et al*.,[10] incidence of preterm birth was 21.2%. Preterm birth in our study was defined as gestation age less than 37 weeks. Fourteen neonates required NICU stay (16.08%). Two neonates required continuous positive airways pressure in postnatal period. Neonatal APGAR score of ≤8 was defined as low APGAR score in our study. Mean 1-minute APGAR score was 7.55 + 1.46 and 5-minute mean APGAR score was 9 + 1.57. There was no case of neonatal death in our study, although two cases of intrauterine fetal death were noted. In an Iranian case series of nine cases, there were four cases of intrauterine fetal deaths and two cases of neonatal deaths in nine patients with severe COVID-19 pneumonia.[11] In a recent systematic review of consecutive case series, one-third of neonates were transferred to NICU for the need of further investigations and monitoring. One cases each of neonatal asphyxia and neonatal deaths were also noted.[2]

## CONCLUSION

Parturients with severe COVID-19 disease had higher mortality. No statistically significant association was found between number of comorbidities and severity of COVID-19. The results of this study will guide us regarding further management and prognostication of COVID-19-positive parturients.

### Authors' contributions

Megha Soni contributed to concept, design, literature search, and definition of intellectual content. Mamta Kumari helped in data acquisition and literature search. Niharika Grover was involved in literature search and manuscript preparation. Rashmi Taneja contributed to definition of intellectual content, manuscript editing, and review. Lokesh Parashar statistically analyzed the study. Rashmi Taneja is the guarantor and takes the responsibility for the integrity of work as a whole from inception to published article.

### Declaration

This manuscript has been read and approved by all the authors, requirements for authorship have been met, and each author believes that the manuscript presents the honest work. Article is not published nor under consideration, in part or whole simultaneously in any other journal or any other proceedings.

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### Conflict of interest

None declared.

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