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Nosocomial COVID-19 infection in women undergoing elective cesarean delivery: a prospective cohort study

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BACKGROUND: The COVID-19 pandemic placed obstetricians in a difficult position of continuing to perform elective cesarean delivery without the knowledge of the risk of the spread of nosocomial infection of the COVID-19 virus.

OBJECTIVE: This study aimed to determine the nosocomial infection rate in women undergoing elective cesarean delivery at 2 academic institutions.

STUDY DESIGN: This nonrandomized prospective cohort trial evaluated patients undergoing elective cesarean delivery during the reopening phase of the COVID-19 pandemic in the state of New York at 2 large volume labor and delivery units. Eligible patients with a negative preoperative reverse transcriptase-polymerase chain reaction test and immunoglobulin G antibody test for COVID-19 were retested 6 to 9 days after discharge. The primary objective was the COVID-19 test conversion rate defined as a positive polymerase chain reaction test for SARS-CoV-2 after discharge with a negative preoperative test. This was used as a proxy for the nosocomial infection rate.

RESULTS: A total of 136 patients were screened for participation. Of these patients, 2 tested positive for COVID-19 on preoperative testing, and 25 declined to participate. Overall, 111 patients consented to participate, and 96 patients underwent both preoperative and postoperative testing. No patient with a negative polymerase chain reaction test preoperatively, had a positive polymerase chain reaction test for the COVID-19 virus postoperatively.

CONCLUSION: With strict and methodical perioperative and postpartum protocols, we can limit nosocomial COVID-19 infection in women undergoing elective cesarean delivery.

Key words: cesarean delivery, COVID-19, nosocomial infection

In response to the COVID-19 pandemic, the US Surgeon General, Centers for Disease Control and Prevention (CDC), and surgical societies recommended suspending nonurgent surgical procedures in March 2020.[1–4] A similar approach was followed worldwide, with an estimated 28 million cases canceled or postponed.[4] Based on recommendations from the American College of Surgeons,[5] elective surgical procedures resumed nationwide during the summer of 2020. During this unprecedented time, the incidence of nosocomial infection among those undergoing elective surgical procedures remains unknown. Furthermore, because of their time-sensitive nature, elective cesarean deliveries was never halted during the COVID-19 pandemic.

The decision to resume and continue elective surgical procedures during the pandemic was done at the local level. Hospitals were expected to interpret their county's incidence and capacity for both patients with positive tests and negative tests for COVID-19 infection and extrapolate their ability to maintain elective surgical procedures. As demonstrated by Wu et al,[6] there is not always a clear answer for hospital systems, and a hypothetical question of whether to halt or continue elective procedures was met with 3 differing, but equally plausible, responses. Multiple reviews have shown that elective surgical procedures performed on patients with known COVID-19 infection had significantly worse perioperative morbidity and mortality rates.[7,8] Retrospective medical record reviews from the height of the pandemic in March 2020 and April 2020 suggested that closed units were could maintain a low rate of nosocomial COVID-19 infection, between 0% and 2%.[9,10] These trials were done in hospitals that were overwhelmed by the initial COVID-19 surge and isolated patients that tested negative from those that tested positive for SARS-CoV-2. Furthermore, the COVID-19 pandemic has significantly affected pregnant women worldwide.[11–13] Because of these effects, our institution began routinely testing all patients undergoing elective surgical procedures, including cesarean delivery for COVID-19. To the best of our knowledge, there has not been a prospective trial to demonstrate the nosocomial COVID-19 infection rate in elective surgical procedures.

We aimed to determine the COVID-19 test conversion rate in patients undergoing elective cesarean delivery. The test conversion rate was used as a proxy for our institutional nosocomial infection rate in surgical patients as it would not be possible to prove that any infections were acquired during the hospital stay.

Materials and Methods

The primary objective of this study was to determine the nosocomial infection rate in women undergoing scheduled cesarean delivery at a New York academic institution during the COVID-19 pandemic. The study was undertaken from June 26, 2020, to September 4, 2020. Patients were assessed for the trial by the research team and operated on by their primary obstetrician. All patients were required to have a negative polymerase chain reaction (PCR) for COVID-19 before enrollment into the study. If patients agreed to participate, they were screened with a preoperative survey to assess for symptoms or

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AJOG MFM at a Glance

Why was this study conducted?

Currently, there has been no study demonstrating the nosocomial COVID-19 infection rate in patients undergoing elective surgical procedures.

Key findings

We found that if strict perioperative protocols are maintained, there is a 0% rate for patients undergoing elective cesarean delivery to develop COVID-19 infection.

What does this add to what is known?

This study demonstrated that elective cesarean delivery can be performed safely amid the current COVID-19 pandemic.

exposure to COVID-19 in the 14 days before their scheduled cesarean delivery and SARS-CoV-2–specific serum immunoglobulin G antibody test. All enrolled patients underwent their scheduled cesarean delivery and postoperative care in a private room in a COVID-19–free postpartum ward.

Patients of any ethnic background undergoing scheduled cesarean delivery were eligible for the trial if they were ≥18 years old and had no previous exposure to patients with COVID-19, symptoms of COVID-19, or positive PCR or serum antibody test for SARS-CoV-2. Participants were excluded if they were admitted to the hospital before their scheduled cesarean delivery, were deemed a person under investigation for COVID-19, were taking antiviral medications, had documented immunodeficiency, or had a severe or uncontrolled concurrent medical disease. Once enrolled, patients underwent their scheduled cesarean delivery and postoperative course and discharge. Furthermore, they returned for a second COVID-19 PCR test and postoperative survey 6 to 9 days after discharge. Indications for scheduled cesarean delivery included repeat cesarean delivery, primary elective cesarean delivery, and primary cesarean delivery for fetal malpresentation.

The primary endpoint of this trial was a positive COVID-19 PCR 6 to 9 days after discharge from the hospital. This was used as a proxy for the nosocomial infection rate of COVID-19 in women undergoing elective surgical procedure during the COVID-19 pandemic. We screened 287 women undergoing same-day admission for an elective cesarean delivery at 2 Northwell Health academic institutions during the trial period. This trial was investigator initiated with no external funding or sponsor. Study data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Northwell Health. REDCap is a secure, web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture, (2) audit trails for tracking data manipulation and export procedures, (3) automated export procedures for seamless data downloads to common statistical packages, and (4) procedures for data integration and interoperability with external sources.[14,15] Confidence intervals (CIs) were calculated using the Wilson score interval. All statistics were performed using IBM SPSS Statistics for Macintosh (Version 27.0; released 2020; IBM Corp, Armonk, NY).

TABLE
Patient demographic information

Characteristic	Value
Age (y)	34.7 (20.7–49.9)
Ethnicity	
White	58 (52.2)
African American	14 (12.6)
Asian	20 (18.0)
Hispanic	1 (0.9)
Other	18 (16.2)
Body mass index (kg/m^2)	33.9 (22.4–58.2)
Hypertension	9 (9.4)
Asthma	2 (1.8)
Diabetes mellitus	7 (7.3)
Hypothyroidism	7 (7.3)
Hospitalization (d)	3 (2–5)
14-d readmissions	2 (1.8)
Preoperative positive COVID-19 PCR	0 (0.0)
Preoperative positive COVID-19 serology	0 (0.0)
Postoperative positive COVID-19 PCR	0 (0.0)

Data are presented as median (interquartile range) or number (percentage).

PCR, polymerase chain reaction.

Nizam. Postoperative COVID-19 nosocomial infection in cesarean delivery. Am J Obstet Gynecol MFM 2021.

Results

During the trial period, a total of 136 patients were approached for participation. Of these patients, 2 patients tested positive for COVID-19 on preoperative testing, and 23 patients declined participation. Overall, 111 women consented to participate in the study. Of 111 women, 96 underwent postdischarge PCR evaluation for SARS-CoV-2 with

15 patients either lost to follow-up or declined the postdischarge PCR evaluation. All 111 patients completed the preoperative and postoperative surveys.

Demographic information have been shown in the Table. The mean age was 34.7 years (range, 20.7−49.9). The race and ethnic distribution were as follows: White (52.2%), African American (12.6%), Asian (18%), Hispanic (0.9%), and other (16.2%) Most patients in our cohort classified themselves as those who never smoked (94.8%), and only 2 patients reported any prepregnancy pulmonary issues (asthma). All patients had regional anesthesia for the procedure with either a spinal block or combined spinal block with epidural catheter placement, and no patient underwent endotracheal intubation. The median hospital stay was 3 days (range, 2−5 days). Postoperatively, all patients were admitted to private rooms on a postpartum floor with no patient with COVID-19 or patient under investigation. The rates of medical comorbidities, including obesity, hypertension, diabetes mellitus, and asthma, were representative of our typical patient population.[16,17]

Results of the preoperative and postoperative surveys are shown in the Figure. Preoperatively, no patient reported symptoms or exposure to patients with COVID-19 within 14 days of their scheduled cesarean delivery. Furthermore, no patient gathered in a group of ≥10 people before their cesarean delivery. Postoperatively, no patient reported symptoms or exposure to patients with COVID-19; however, 4 patients (3.6%) reported participating in an event with >10 participants. None of the 96 patients tested postoperatively were positive with a 0% test conversion rate in our patients (95% CI, 0.000−0.039). This rate was used as a proxy for the nosocomial infection rate of COVID-19. Moreover, 2 patients were readmitted after discharge who tested negative at both their scheduled postoperative PCR appointment and on readmission to the hospital. There was no readmission for COVID-19 within 14 days following a surgical procedure in our cohort.

Discussion

Principal findings

During the last year, the COVID-19 pandemic has changed the way we live our lives and practice medicine. Many hospital guidelines were developed quickly in response to rapidly accumulating data. Many hospitals were overwhelmed and faced surge capacity and inadequate personal protective equipment. Our study was performed during the initial reopening phase after all New York City elective surgical procedures were halted during March 2020 and April 2020. To protect our expectant mothers, our institutional protocol was to test all patients before their cesarean delivery and to isolate all patients without COVID-19 during their intraoperative and postpartum hospital courses. All patients and providers were required to wear masks during any patient encounters.

Clinical implications

We could demonstrate a 0% test conversion rate for COVID-19 in women undergoing elective cesarean delivery during the New York City reopening phase for elective surgical procedures. This served as a proxy for our nosocomial infection rate for elective cesarean delivery. At the height of the initial wave in New York City, our hospital's intensive care unit (ICU) and non-ICU beds were beyond 100% capacity, and by the end of our recruitment period, only 1.02% of emergency and inpatient admissions were for an active COVID-19 infection.[18] However, by maintaining strict perioperative and postpartum protocols, we could limit any hospital-acquired COVID-19 infections in this population. As many other studies have shown, isolation and universal mask compliance by staff members can decrease infection significantly.[19−21]

Moreover, the use of preoperative and postoperative questionnaires improved our ability to ensure that any COVID-19 infections were not acquired before cesarean delivery or after discharge. As anticipated, none of our patients were symptomatic or exposed to a patient with COVID-19 before or after cesarean delivery. There were 4 patients that did gather in a group >10 within the perioperative period. None of these patients became symptomatic or converted during the study period. The decision to limit groups to 10 was based on the state of New York and CDC guidelines to limit personal gatherings to <10 people at the time.

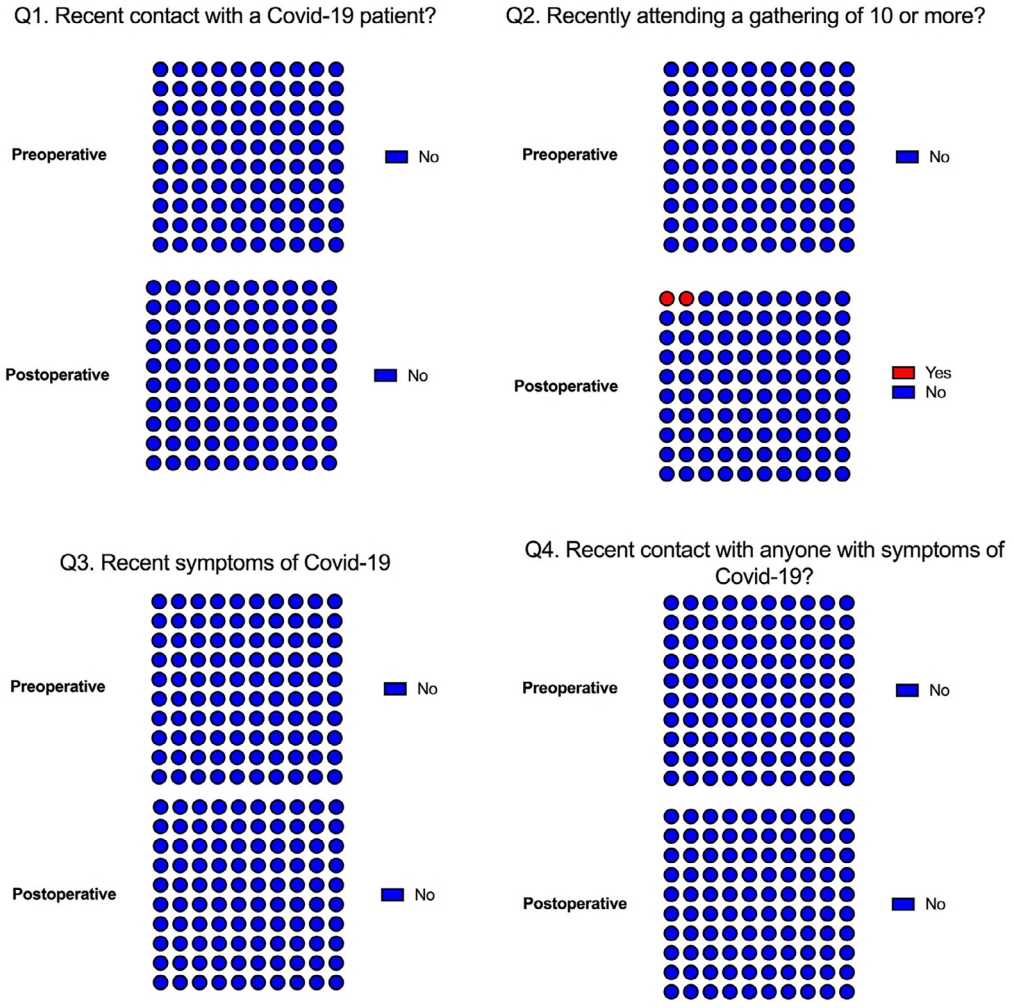
Research implications

We did not assess the nosocomial infection rate in unscheduled labor admissions or scheduled inductions of labor. Such data could be beneficial for the management of labor and delivery units during the pandemic. Because of the timing of the study period, we could not assess the effect of vaccination on the spread of nosocomial infection of the COVID-19 virus in obstetrical patients.

Strengths and limitations

The strengths of this study included the prospective design to identify any patients that tested positive for COVID-19 within 10 to 14 days from their elective cesarean delivery. This prospectively designed study focused on nosocomial infection rates of SARS-CoV-2 in elective surgical procedures. The exclusive recruitment of patients undergoing elective cesarean delivery was intended to create a homogenous population with a typical hospital course of 2 to 3 days in a COVID-19−free ward. The limitations of this study included a significant number of patients lost to follow-up or patients that dropped out after initially consenting to participate in the study. Those that withdrew cited pain during the initial PCR test and fear of leaving their house after hospital discharge. To minimize lost patients because of the latter issue, we employed an outpatient home delivery testing service, which significantly decreased patients that withdrew from the study. Moreover, we used test conversion as a proxy for our nosocomial infection rate because of our innate inability to prove that any infections acquired postoperatively were definitively acquired in the hospital. However, as there was no test conversion, we could state that there was no hospital-acquired infection.

FIGURE
Results of the COVID-19 questionnaire in the preoperative and postoperative periods



Nizam. Postoperative COVID-19 nosocomial infection in cesarean delivery. Am J Obstet Gynecol MFM 2021.

Conclusion

We found a 0% (95% CI, 0.000−0.039) nosocomial infection rate in our study participants undergoing elective cesarean delivery, during the initial reopening phase of elective surgical procedures in the state of New York. We have demonstrated that if methodical perioperative and postpartum protocols are enacted, then hospitals can successfully protect patients from acquiring COVID-19 infection during elective surgical procedures. Furthermore, this data can be used to guide the management of elective surgical procedures during future COVID-19 outbreaks or other respiratory and nonrespiratory pandemics worldwide. For the future restoration of elective surgical procedures, we must continue to work to employ strategies to limit nosocomial infection of COVID-19. ■

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Informed consent was obtained from all patients before participating in our study.

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