Examining Outcomes for Nulliparous, at Term, Singleton and Vertex Deliveries During the First Wave of the COVID-19 Pandemic in Rhode Island

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ABSTRACT

BACKGROUND: During the initial wave of the COVID-19, there was uncertainty related to whether the pandemic would affect pregnancy delivery outcomes. We sought to identify whether changes in hospital policies and provider practices, driven by COVID-19, would influence delivery outcomes in nulliparous, term, singleton, vertex (NTSV) pregnancies in Rhode Island.

OBJECTIVE: We compare the delivery outcomes and associated factors for NTSV deliveries during the first wave of the COVID-19 pandemic in Rhode Island compared to patients who delivered the year prior.

STUDY DESIGN: This is a retrospective cohort study of patients who presented to Women & Infants Hospital for NTSV deliveries during April 2019, pre-COVID-19, and April 2020, during COVID-19.

RESULTS: During COVID-19, patients were more likely to have abnormal electronic fetal monitoring (AEFM) as an indication for cesarean section ($p<.02$) and less likely to have an elective cesarean delivery ($p<.01$). Patients during COVID-19 were more likely to have a midwife involved in their care compared to pre-COVID-19 ($p<.001$). The cesarean section rate was not statistically different between the two time periods.

CONCLUSION: Those delivering during the pandemic were more likely to have AEFM as an indication for cesarean delivery and less likely to have elective cesareans. They were more likely to have a midwife involved in their care. Further investigation into factors associated with changes in NTSV cesarean rates is warranted.

KEYWORDS: pregnancy, cesarean delivery, NTSV, COVID-19

INTRODUCTION

During the initial wave of the COVID-19 pandemic, little was known about how healthcare in the United States would be affected by the virus, and even less was known about how it would affect maternal health.[1] One question during this period of uncertainty was whether healthcare delivery or hospital protocols would be impacted by concerns surrounding the virus. Childbearing patients had little choice in presenting for care during this time period and were subject to the ever-changing landscape of the COVID-19 pandemic during their delivery. Prior to the pandemic, there was significant variation around care delivery for maternal health and childbirth in the United States, with COVID-19 acting as an additional complicating factor.

Patients who are nulliparous, at full term, with a singleton pregnancy in vertex presentation (NTSV) are used as a standard population to compare variation in cesarean section rates throughout the United States.[2] It is well known that cesarean rates for this population vary dramatically throughout US hospitals, ranging from 6% to 69%.[2] Over 90% of these differences can be attributed to provider variation in determination of "fetal intolerance of labor" and "failure to progress," indicating that there is a large component of subjective assessment contributing to the NTSV cesarean rate.[2-3] Cesarean deliveries have increased precipitously in recent years and are well over the recommended goal from the US Healthy People 2020 goal of less than 23.9%.[4]

Prior studies have addressed factors contributing to NTSV cesarean rates; however, these studies have not included the impact of a global pandemic on delivery outcomes. Our hypothesis was that the COVID-19 pandemic has impacted current obstetric practice and delivery outcomes, including the NTSV cesarean rate. The objective of this study was to compare delivery outcomes and associated factors for NTSV deliveries within the context of the COVID-19 pandemic to pre-COVID-19 data the year prior at Women & Infants Hospital, the only tertiary care obstetrics facility in Rhode Island.

MATERIALS AND METHODS

A retrospective cohort analysis was performed comparing patients with NTSV pregnancies who delivered at Women & Infants Hospital in Providence, Rhode Island, from April 2019, pre-COVID-19, and April 2020, during COVID-19. The primary outcome was cesarean rate in NTSV pregnancies in the two time periods. Women with nulliparous, term, singleton, vertex (NTSV) pregnancies were included in the analysis in accordance with prior studies.[2] The study timeframe included April 23, 2020 which was the first peak of COVID-19 cases in Rhode Island.[5] The study was exempt from the hospital's institutional review board under quality improvement designation.

Through a retrospective chart review, deidentified data was extracted from the hospital electronic health record (EHR) and recorded with a standardized REDCap data collection form.[6] Collected patient data included month of delivery, patient age, ethnicity, mode of delivery, indication for cesarean section if they received one, whether the patient was induced, had an epidural, if they had artificial rupture of membranes and whether they had a midwife involved in their care. Apgar scores at 1 and 5 minutes were also collected.

Patients were defined as having had a midwife involved in their care if there was documentation within the EHR that a midwife wrote a note for the patient or was the delivering provider. Indications for cesarean section were classified as failed induction, first-stage arrest, second-stage arrest, abnormal/indeterminant electronic fetal monitoring (AEFM), chorioamnionitis, elective, and other.[7-10] First-stage arrest was defined as 6cm or greater dilation with membrane rupture and no cervical change for 4 hours or more of adequate contractions or 6 hours if contractions inadequate. Second-stage arrest was defined as at least 2 hours of pushing in multiparous patients and 3 hours of pushing in nulliparous patients without delivery.[7-10] All other information was taken from documentation in the delivery record.

Comparisons were made between mode of delivery of NTSV pregnancies and the patient demographics, indications for cesarean delivery and delivery details between the two groups. There was no established measure of expected effect size in the existing literature, so a traditional power analysis was not used as it would have been difficult to validate. To compare characteristics, Chi-Square or t-tests were used for categorical and continuous data. Fisher's exact test was used in certain circumstances such as to test small sample sizes. Statistical analyses were performed using STATA/SE version 15 (StataCorp Inc., College Station, TX, USA).

RESULTS

General Characteristics

There were 489 NTSV deliveries during the two sample periods with 235 deliveries in April 2019 and 254 in April 2020. Overall, the mean age of the sample was 27.8 ± 5.3 years (SD=5.3) and the ethnicity of the sample was 54.8% White, 27.2% Hispanic/Latinx, 8.4% Black, 4.7% Asian, and 4.9% other or not listed (**Table 1**). There was no statistically significant difference in age (p=0.51) or ethnicity (p=0.46) between the two time periods.

Table 1. Patient Demographics of NTSV Deliveries Comparing Pre-COVID-19 (2019) and COVID-19 (2020)

	April 2019	April 2020	Total
Age (yrs)	27.7	28.1	
Ethnicity (n)			
White	130	138	268
Hispanic/Latino	64	69	133
Black	18	23	41
Asian	14	9	23
Other/Not listed	9	15	24

Delivery Outcomes

The total deliveries comparing the pre-COVID-19 to COVID-19 time period were respectively 235 vs 254 deliveries in 2019 vs 2020. There were no significant differences in the rates of spontaneous vaginal delivery (65.5% vs 63%, p=0.69), operative delivery (6.8% vs 4.3%, p=0.23) and cesarean delivery (28% vs 32% p=0.31) between the two time periods of pre-COVID-19 vs COVID-19 (**Table 2**). There was no significant difference in rates of induction (43.4% vs 44%, p=0.81), artificial rupture of membranes (42% vs 41.7%, p=0.98) and epidurals (91.4% vs 95%, p=0.09) between the two groups. There was no difference in 1 min. and 5 min. APGAR scores between the two groups. Comparing the number of patients in each group that received midwifery care in labor pre-COVID-19 period vs COVID-19 period, there was higher rate of patients receiving midwifery care in the COVID-19 period in 2020 (11% vs 34%, p=<0.001).

Table 2. Delivery Information Comparing Deliveries Pre-COVID-19 (2019) and COVID-19 (2020)

	April 2019	April 2020	p-value
Total deliveries (n)	235	254	
Inductions (n)	102	112	0.81*
Artificial rupture of membranes (n)	99	106	0.98*
Epidural (n)	215	242	0.09*
Midwifery care (n)	26	87	<0.001*
Apgar 1 min.	7.2	7.5	0.09**
Apgar 5 min.	8.7	8.9	0.17**
Mode of delivery			
Spontaneous vaginal delivery (n)	154	162	0.69*
Operative vaginal delivery (n)	16	11	0.23*
Cesarean delivery (n)	65	81	0.31*

*Chi-square analysis
**Wilcoxon signed-rank test

Indications for Cesarean Delivery

The documented indications for cesarean delivery included (**Table 3**): arrest of descent in first stage of labor, arrest of descent in second stage of labor, abnormal electronic fetal heart monitoring (AEFM), failed induction, elective, and other (placenta previa, active HSV infection, gestational hypertension, failed operative delivery). Comparing the two time periods, pre-COVID-19 and COVID-19, there

was statistically significant difference in elective cesarean deliveries with less occurring during the COVID-19 period (21.5% vs 6.2%, p=0.02). There was also a higher rate of cesarean deliveries for AEFM during the COVID-19 time period (21.5% vs 45.7%, p=0.002).

Table 3. Indications for Cesarean Delivery Comparing pre-COVID-19 (2019) and COVID-19 (2020)

	April 2019	April 2020	p-value
Cesarean deliveries Total (n)	65	81	0.31*
First-stage arrest (n)	18	12	0.18*
Second-stage arrest (n)	15	20	0.52*
Abnormal electronic fetal monitoring (n)	14	37	0.002*
Failed induction (n)	1	2	1.0**
Elective (n)	14	5	0.02*
Chorioamnionitis (n)	0	1	1.0*
Other (n)	2	4	0.78*

*Chi-square analysis
**Fisher's exact test

Further Analysis of Midwifery Care

We examined our cohort, combining the pre-COVID-19 and COVID-19 groups, and regrouping into pregnant individuals who did not receive midwifery care versus those who did receive midwifery care to examine if the presence of midwifery care affected the mode of delivery. The individuals who had midwifery care had higher rates of spontaneous vaginal (61.7% vs 74.3, p=0.01) and lower rates of cesarean deliveries (27.9% vs 19.5%, p=0.006); however, there was no difference in operative (5.3% vs 6.2%, p=0.72) deliveries (**Table 4**). There was a significant association between midwifery care and the delivery type (X^2 (2)=7.5782, p=0.023).

Table 4. Evaluation of Midwifery Care on Rates of Mode of Delivery

Mode of Delivery	No Midwifery Care	Midwifery Care	p-value
Spontaneous vaginal delivery (n)	232	84	.01*
Operative vaginal delivery (n)	105	22	.72*
Cesarean delivery (n)	20	7	.006*

*Chi-square analysis

DISCUSSION

Principal Findings

Our study suggests that the COVID-19 pandemic has affected delivery indications and delivery of care for patients presenting for childbirth. There was a significant increase in AEFM as the indication for cesarean delivery in the COVID-19 time period in April 2020. There was also a decrease in patients presenting for elective cesarean delivery during the period of the COVID-19 pandemic in April 2020. There was higher usage of midwives for care during the pandemic study period in April 2020. Patients who had a midwife involved in their care had higher rates of spontaneous and operative deliveries compared to patients who did not have a midwife involved in their care, however this part of the study was not sufficiently powered.

Results

Although there is still much to be learned from pregnancy in the context of COVID-19, there is some emerging research showing that the pandemic has altered pregnancy outcomes. One site saw a decrease in overall cesarean deliveries, driven by a significant decrease in cesareans without a trial of labor.[11] At this time it is unclear whether that change was driven by provider or patient practice. Other studies have noted a significantly decreased postpartum stay during the pandemic, without changes in cesarean delivery rates, induction of labor, or adverse maternal or fetal outcomes.[12] Our research has a smaller sample size, but also suggests that there have been changes in provider practice and hospital policies, and therefore pregnancy outcomes, which have been driven by the COVID-19 pandemic.

Clinical Implications

Fetal tracings are known to have marked intra- and inter-observer variability and so can be unreliable indicators of fetal well-being.[13-15] Studies have shown that provider attitudes contribute to variance in NTSV cesarean rates, and it is possible that concerns surrounding the COVID-19 virus and its perceived risk contributed to these changes.[16] However, the non-significant difference between APGAR scores between the two time periods suggest that infant outcomes were largely unchanged during the pandemic.

The significant decrease in elective cesarean deliveries could be attributable to patient hesitancy surrounding being in the hospital for the additional recovery days usually necessary after a cesarean, or increased concern around contracting COVID-19 during an operation, or of a newborn contracting the virus during a prolonged hospital stay. It is also possible that physicians were less likely to offer elective cesareans to their patients for the aforementioned concerns. This study did not directly assess provider sentiments related to delivery decisions during the pandemic, and this is an important area for future study.

Changes in midwifery involvement may have been related to midwives covering more laboring patients during the pandemic secondary to changes in workflow and personnel available to cover laboring patients. Patients who had a midwife involved in their care had higher rates of spontaneous and operative deliveries compared to patients who did not have a midwife involved in their care, however this part of the study was not sufficiently powered. This is in line with national data and suggests that increased midwifery presence on the labor floor may help to decrease cesarean delivery rates amongst NTSV delivery candidates.[16-21]

Research Implications

More information is needed into whether this increase in AEFM as indication for cesarean delivery was based on physiologic differences in maternal fetal tracings during the pandemic, or a decrease in provider willingness to tolerate abnormal fetal tracings. This study did not directly assess provider sentiments related to delivery decisions during the pandemic and this is an important area for future study, given the significant decrease in elective cesarean deliveries and increase in AEFM as indication for cesarean delivery. Furthermore, the impact of team-based models of care that involve midwives on NTSV rates should be further explored.

Strengths and Limitations

This research is unique in that it contributes to information about the effects of COVID-19 on birth outcomes and is focused on the state of Rhode Island and the primary hospital for deliveries in the state. Women & Infants Hospital is the only tertiary care center in Rhode Island and includes a diverse population. Even though there were no differences in the NTSV during these two periods pre-COVID-19 April 2019 vs COVID-19 April 2020, it is important to note that both months had cesarean rates higher than the rate recommended by Healthy People 2020.[4] It is known that cesarean deliveries have risks for morbidity to mothers and their babies.

Limitations of this study include being conducted as a retrospective study within the continually evolving context of the COVID-19 pandemic. This includes changes in hospital protocol during the study timeframe. The data also draws upon only one hospital within Rhode Island, which also represents a tertiary care center leading to more complex patients who may require higher levels of intervention. The sample includes only NTSV deliveries, so this research may be missing key differences among other delivery populations. Additional limitations include that the study did not assess changes in complications during pregnancy including changes in preeclampsia rates, the number of patients with prior or current diagnoses of COVID-19 and how care practices were altered to treat patients who were COVID-19 positive during delivery.

CONCLUSIONS

Examining NTSV delivery rates in April 2019 pre-COVID-19 to April 2020 COVID-19, patients who had deliveries during the pandemic period were more likely to have AEFM as their indication for delivery and less likely to have elective cesareans. The patients giving birth during the pandemic were also more likely to have a midwife involved in their care, possibly due to changes in models of care and workflow related to COVID-19 pandemic. The COVID-19 pandemic has affected care practice, use of midwives and the indications for cesarean delivery in the state of Rhode Island.

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