

Research Article

Effects of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) Delta variant (B.1.617.2) on maternal and neonatal outcomes

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Background

Coronavirus 2019 (COVID-19) infection during pregnancy has been reported to increase the risk of adverse maternal and perinatal outcomes. Data from the general population suggests that the Delta variant infection is associated with more severe disease than the Alpha variant. However, there is limited data available on the impact of delta variant infection during pregnancy on perinatal outcomes. This study aimed to evaluate the effects of SARS-CoV-2 delta variant infection during pregnancy on maternal and neonatal outcomes.

Methods

In this retrospective, single-center study, we included all infants who were born from May 2020 through October 2021 to mothers with COVID-19 infection during pregnancy. At our institution, we started inpatient testing of all obstetric patients on admission on May 29, 2020. In our region, the Delta variant accounted for more than 80% of all COVID-19 infections from July 2021. Maternal and neonatal outcomes were compared between the pre-Delta (May 2020–June 2021, n = 20) and Delta groups (July 2021–October 2021, n = 52).

Results

In comparing the Pre-Delta to Delta groups, there were no significant differences in the rates of maternal chorioamnionitis, gestational hypertension, diabetes, antepartum bleeding, c-section, maternal ICU admission, maternal COVID-19 symptoms, and maternal survival. All neonates born to these mothers tested negative for COVID-19. The rates of premature birth, Apgar score of less than 5 at 5 minutes, small for gestational age, microcephaly, need for noninvasive or invasive ventilator support, hypoxic ischemic encephalopathy, culture positive sepsis, and neonatal survival were not different between the two groups. There was no difference in placental findings between the two groups. However, infants born to symptomatic mothers in the Delta group had a higher rate of preterm delivery.

Conclusions

Based on our study, the Delta variant of COVID-19 can increase preterm birth rates among symptomatic mothers. Further meta-analysis of available studies is needed to evaluate its effect on neonatal outcomes.

The coronavirus disease 2019 (COVID-2019) pandemic, caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus, has been a serious public health emergency, especially among vulnerable populations such as pregnant women. According to the Centers for Disease Control (CDC), pregnant women are at an increased risk for severe illness from COVID-19 infection compared with the non-pregnant population.¹ Previously reported

studies suggest that pregnant women with COVID-19 Alpha variant (B.1.1.7) infection are at increased risk for maternal morbidities including pre-eclampsia, preterm birth, still birth, as well as neonatal morbidities.²⁻⁴

The emergence of the Delta variant (B.1.617.2), a novel variant of SARS-CoV-2, quickly displaced the B.1.1.7 (Alpha) variant, which challenged the health system all over the world. In our region, the surge of Delta variants increas-

ing the infection and hospitalization rate started in July 2021. The Delta variant predominated with an infectivity rate of >80% by the end of July. In the general population, compared with the Alpha Variant SARS-CoV-2, the Delta variant is 50-60% more transmissible and has resulted in a substantially higher number of cases, hospitalizations, and deaths.⁵⁻⁸ We also witnessed an increase in the number of hospitalized pregnant mothers with COVID-19 infection at our institution during the period of the Delta variant surge across the nation. Previous studies have reported that Delta variant infection is associated with severe disease requiring hospital admissions in pregnant women, especially in unvaccinated pregnant women.^{9,10} In addition, Seasey et al also reported an increase in the incidence of preterm births.¹⁰ The increased susceptibility of pregnant mothers to COVID-19 infection might be due to a compromised immune system during pregnancy, resulting in impaired viral clearance, hyperinflammation, and poor outcomes.¹¹ The lower vaccination rate in pregnant women when compared to the general adult population may also increase the morbidity of SARS infection in this population.¹² Only sparse data is available on the effects of the Delta variant on pregnant mothers and the neonates born to these infected mothers. Therefore, we sought to evaluate the maternal and neonatal outcomes of maternal SARS-CoV-2 Delta variant infection during pregnancy.

METHODS

This single-center, retrospective cohort study was conducted at the University of South Alabama, Mobile, Alabama after approval was granted by the Institutional Review Board. Beginning May 29, 2020, at our institution, all pregnant individuals presenting to obstetric triage and labor and delivery rooms were tested via nasopharyngeal swab to detect SARS CoV-2 infection using Abbot ID NOW COVID-19. In addition to those identified upon admission, we included all pregnant women with SARS-CoV-2 infection during any time of pregnancy. Before June 2021, most coronavirus infections in our region were identified as the Alpha variant (B.1.1.7) SARS CoV-2, but by July 2021, the Delta variant predominated with a rate of >80% by the end of July. In addition, in the absence of laboratory-identified SARS-CoV-2 variants, we considered the COVID-19 infected mothers to be infected with the Delta variant in July to October 2021 based upon the regional and nationwide prevalence of Delta variant infection. Maternal and infant data was collected on infants who were born between May 2020 and Oct 2021 at our institution. Based on the regional prevalence of coronavirus variants during different time periods, patients were categorized as pre-Delta (May 29, 2020–June 30, 2021) or Delta (July 1, 2021–October 30, 2021). We further classified the Delta cohort into an asymptomatic(n=35) or symptomatic(n=18) mothers. Any symptom in pregnant mothers ranging from mild illness to severe disease requiring ICU admission was included in symptomatic mothers' group. Data was collected on maternal and neonatal demographics, maternal morbidities, severity of SARS-CoV-2 infection requiring ICU admission,

mode of delivery, preterm births, neonatal morbidities, and maternal and neonatal survival and outcomes including the follow up within a month after discharge. Maternal and neonatal morbidities and outcomes were compared between the pre-Delta and Delta groups. We also compared perinatal outcomes between asymptomatic and symptomatic mothers in the Delta group.

All the statistical analyses were performed using Stata 14 (Stata Corp. LP, College Station, TX). For unadjusted analysis, we analysed categorical data with chi-square and Fisher's exact tests. Normally distributed continuous data was analysed by student's t-test. We applied the Mann-Whitney U test for the analysis of ordinal and continuous data that were not normally distributed. Statistical significance was considered with a *P*-value less than 0.05.

RESULTS

A total of 76 women with COVID-19 infection during pregnancy and who gave birth in our tertiary hospital were included: 23 in the pre-Delta period and 53 in the Delta period (see Online Supplementary Document for raw data). Patient distributions were similar between the two groups. During this period, all pregnant women took prenatal vitamins. None of them were given hydroxychloroquine or ivermectin. Amid pre-Delta COVID illness, a higher proportion of pregnant women took vitamin C ([Table 1](#)). While in the Delta group, the pregnant women who took vitamin D, zinc, or other agents were asymptomatic. The average gestational age at the time of COVID-19 diagnosis was similar between the two groups. Maternal intensive care unit (ICU) admissions were increased in the Delta period as compared with the pre-Delta period, but this was not statistically significant (4.4% pre-Delta vs 11.3% Delta group, *P*= 0.334). Other maternal morbidities and outcomes, including maternal chorioamnionitis, preeclampsia, diabetes, placenta abruptio, cesarean section, maternal COVID-19 symptoms, and maternal survival, were not different between the two groups ([Table 1](#)).

The neonatal morbidities and survival were also similar in these 2 groups ([Table 1](#)). None of the neonates born to these mothers tested positive for coronavirus at 24 and 48 hours after birth during these two time periods. There was no difference in placental findings, including the rate of placental malperfusion, placental thrombosis, and decreased placental size, between the two groups.

In the Delta group, when compared to the asymptomatic mothers, the symptomatic mothers had a higher rate of preterm birth (55.6% vs 22.9%, *P*=0.017) ([Table 2](#)). Neonatal survival was also decreased in the symptomatic mother group as compared to the asymptomatic mother group (88.9 % vs 100 %, *P* =0.044) ([Table 2](#)). Furthermore, adverse neonatal composite outcomes (any of the morbidities, including delivery room resuscitation, respiratory distress, mechanical ventilation, hypoxic ischemic encephalopathy, culture-positive sepsis, or neonatal death) were higher in neonates born to symptomatic mothers ([Table 2](#)). However, after adjusting for the preterm birth, the adverse neonatal composite outcome was not different between the two

Table 1. Maternal and neonatal demographics and outcomes, according to severe acute respiratory syndrome coronavirus (SARS-CoV-2) variant type

	Pre-Delta (n=23)	Delta (n=53)	p value
Maternal Age, year (median, IQR)	29 (25, 32)	25 (23, 30)	0.336
Gestational age at birth, weeks median (IQR)	36.5 (30, 39)	38 (35, 39)	0.402
Preterm birth <37 weeks (%)	12 (52.6)	18 (33.9)	0.136
Birth weight in gram, mean \pm SD	2394 (968)	2735 (735)	0.101
Female (%)	9 (40.9)	37 (69.8)	0.019
Black (%)	10 (45.5)	26 (47.2)	0.778
Cesarian section (%)	10(43.5)	27 (50.9)	0.550
Maternal Comorbidities			
Maternal Diabetes (%)	2 (8.7)	8 (15.1)	0.432
Maternal Preeclampsia (%)	6 (26.1)	8 (15.1)	0.256
Maternal BMI 35 kg/m ² or higher	7 (30.4)	21 (39.6)	0.446
Maternal Chorioamnionitis (%)	1 (4.4)	1 (1.9)	0.538
Any Maternal COVID - 19 symptoms	4 (17.9)	18 (33.9)	0.143
Maternal intake of Vitamin C (%)	4 (18)	0 (0)	0.002
Maternal intake of Vitamin D, Zinc or other agents (%)	0(0)	3(6)	0.23
Maternal ICU admission (%)	1(4.4)	6 (11.3)	0.334
Gestational age at COVID infection	36.5 (32, 38.5)	35 (31, 38)	0.986
Duration between COVID infection and delivery, weeks mean \pm SD	0.35 (0.75)	2.5 (3.7)	0.063
Placenta abruption (%)	2 (8.7)	3 (5.6)	0.624
Apgar score <5 at 5 mins (%)	1 (4.6)	2 (3.8)	0.877
Delivery room neonatal resuscitation (%)	8 (36.4)	9 (16.1)	0.061
Small for gestational age (%)	6 (27.3)	6 (11.3)	0.086
Microcephaly (%)	2 (9)	2 (3.8)	0.351
Neonatal Mechanical ventilation (%)	2 (9)	26(11.3)	0.426
Hypoxic Ischemic Encephalopathy (%)	0 (0)	3 (5.6)	0.255
Culture positive sepsis (%)	0 (0)	2 (3.7)	0.356
NICU admission (%)	9 (40.9)	17 (32.1)	0.464
Survival			
Maternal Survival (%)	22 (95.7)	53 (100)	0.126
Neonatal Survival (%)	23 (100)	52 (96.3)	0.356
Placenta			
Decreased placental size (%)	1 (12.5)	2 (22.2)	0.6
Placental malperfusion (%)	5 (62.5)	5 (44.4)	0.457
Placental thrombosis (%)	1 (12.5)	2 (22.2)	0.6

IQR– interquartile range, SD- standard deviation.

groups (odds ratio, OR=-0.72, 95% confidence interval, CI=-1.95-0.52, $P=0.25$).

Among the neonates discharged in the Delta group, about two-thirds were followed up within a month (Table 2). There was no difference in the presenting symptoms at the follow-up visit in the infants born to asymptomatic vs. symptomatic mothers (Table 2). None of the infants required rehospitalization. All the COVID tests performed on the infant at follow-up were negative. The long-term outcome of these infants and their symptomatic mothers was not available.

DISCUSSION

In our study, COVID infection with the Delta variant did not affect maternal outcomes compared to the pre-Delta variant. This is in contrast to the previous published reports, which showed a greater likelihood of maternal morbidities with the Delta variant.^{9,10} Furthermore, in contrast to a previously published study,⁹ we did not find an increase in the incidence of neonatal morbidities and preterm delivery in the Delta group when compared with the pre-Delta group. We speculate that the failure to detect a difference in perinatal outcomes could be due to the small sample size. However, among the Delta group, the preterm birth rate was higher in the symptomatic mothers compared to the

Table 2. Neonatal outcomes of maternal COVID-19 Delta variant Infection During Pregnancy, According to Maternal Symptom Status

Neonatal Outcomes	Asymptomatic (n=35)	Symptomatic (n=18)	p value
Preterm birth <37 weeks (%)	8 (22.9)	10 (55.6)	0.017
Small for gestational age (%)	5 (14.3)	1 (5.6)	0.342
Delivery room resuscitation (%)	2 (5.7)	6 (33.3)	0.008
NICU admission	7 (20)	10 (55.6)	0.009
Neonatal respiratory distress (%)	5 (14.3)	7 (38.9)	0.043
Neonatal Mechanical ventilation (%)	2 (5.7)	4 (22.2)	0.072
Hypoxic Ischemic Encephalopathy (%)	0 (0)	3 (16.7)	0.013
Culture positive sepsis (%)	1 (2.9)	1 (5.6)	0.625
Neonatal Survival (%)	35 (100)	146(88.9)	0.044
Adverse neonatal composite outcome* (%)	13 (24)	11 (50)	0.027
Maternal Gestational age during detection of COVID-19 infection in weeks (median, IQR)	36 (33,38)	32.5 (30, 37)	0.213
Maternal COVID-19 vaccination status	2 (13.3)	0 (0)	0.253
Neonatal Follow-up within 1 month after discharge (%)	20 (57)	10 (63)	0.718
Clinic	19 (95)	10 (100)	0.472
ER/Urgent care	1 (5)	0 (0)	0.472
Rehospitalization	0	0	
Any symptom at follows up (fever, cough, diarrhea, vomiting)	1(5)	0	0.472
Covid test done at follow up (%)	6 (30)	1 (10)	0.22

*Any of the following: Delivery room resuscitation, neonatal respiratory distress, neonatal mechanical ventilation, hypoxic ischemic encephalopathy, culture positive sepsis, neonatal death

asymptomatic mothers, unlike previously reported.⁹ This increase in preterm birth rate led to a greater incidence of neonatal morbidities and deaths in infants born to symptomatic mothers in our study. Nevertheless, it did not affect the short-term outcomes of these infants after discharge.

The strength of this study is that it adds to our knowledge about the effects of symptomatic pregnant mothers infected with Delta variant upon the various neonatal morbidities. However, one major limitation of our study is the small sample size. This limits its ability to detect a meaningful difference in outcomes between the pre-Delta and Delta groups. Other limitations include the lack of a laboratory-confirmed SARS-CoV-2 variant and information on maternal COVID-19 vaccination status. This study was unable to determine the impact of pregnant mothers' immunization status on short- and long-term neonatal outcomes. Furthermore, long-term follow-up data on neonates and their symptomatic mothers are not available.

CONCLUSIONS

In conclusion, in a small cohort of pregnant women, Delta variant infection during pregnancy did not appear to increase the risk of adverse perinatal outcomes. However, it may increase the risk of preterm delivery in symptomatic mothers. Further meta-analysis of available studies is needed to identify the detrimental effects of the Delta variant on perinatal outcomes.

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ETHICS STATEMENT

This study protocol was reviewed and approved by the University of South Alabama Institutional Review Board (IRB no: 22-128). This study was approved for waiver of HIPAA authorization and the need for consent was waived by the University of South Alabama Institutional Review Board. This study was conducted according to the Declaration of Helinski.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available in the Online Supplementary Document.

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AUTHORSHIP CONTRIBUTIONS

KD was responsible for writing the protocol, designing the study, extracting data, analyzing data, interpreting results, and editing the manuscript.

SJ was responsible for extracting data, analyzing data, interpreting results, and editing the manuscript.

RG contributed to writing the protocol, designing the study, extracting the data, analyzing data, interpreting results, and providing feedback on the manuscript.

DISCLOSURE OF INTEREST

The authors completed the ICMJE Disclosure of Interest Form and disclose no relevant interests.

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SUPPLEMENTARY MATERIALS

Online Supplementary Document.

Download: <https://www.joghr.org/article/77985-effects-of-severe-acute-respiratory-syndrome-coronavirus-2-sars-cov-2-delta-variant-b-1-617-2-on-maternal-and-neonatal-outcomes/attachment/163852.pdf>
