

The Incidence Rate of NICU Admission following Elective Caesarian Section in Pregnant Women Infected with COVID-19 throughout Pregnancy

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ABSTRACT

Background: In March 2020, the WHO proclaimed the new coronavirus (COVID-19) outbreak a worldwide pandemic. The symptoms of COVID-19-infected pregnant individuals appear to be comparable to those of the general population, with chest symptoms including fever and cough being the most often reported in investigations. Obesity, diabetes, and maternal age greater than 40 years old are risk factors for fatality and serious illness. The greatest risk for severe illness, ICU admission, and the requirement for mechanical ventilation is among women in their third trimester. The aim of this study was to assess the incidence rate of Neonatal intensive care unit (NICU) admission after elective caesarian section in pregnant women admitted to Ain Shams University Hospitals with COVID-19 infection during pregnancy.

Patients and methods: This retrospective cohort study was conducted at Ain Shams University Maternity Hospital from April 2020 to April 2022 and performed on total 20 pregnant women who admitted with COVID-19 during pregnancy documented by polymerase chain reaction test (PCR).

Results: There was no statistical difference regarding NICU admission both groups. Hemoglobin and total leucocytic count were lower in mothers of neonates that needed NICU admission ($P>0.05$). Maternal complications (postpartum hemorrhage, surgical site infection, sepsis) were nearly similar among COVID-19 group and control group ($P>0.05$).

Conclusion: No appreciable differences between pregnant women with COVID-19 infection and those who were not, in terms of APGAR score, NICU hospitalization, wound infection, postpartum hemorrhage, and sepsis. The clinical features of COVID-19 in pregnant patients and newborns appear to be the same as those in infected individuals who are not pregnant.

Keywords: COVID-19, Pregnancy, NICU Admission, APGAR, Postpartum hemorrhage, Low birth weight.

INTRODUCTION

An infectious condition called COVID-19 is brought on by a recently identified corona virus. It was described as an epidemic that was sweeping the globe. The most common symptoms described in studies for COVID-19-infected pregnant individuals are fever and cough, which are comparable to those seen in the general population. Obesity, diabetes, and maternal age greater than 40 years old are risk factors for fatality and serious illness. The largest risk for severe illness, Intensive Care Unit (ICU) admission, and need for mechanical ventilation occurs among pregnant women during the third trimester⁽¹⁾. But, compared to elective caesarean sections, normal vaginal delivery of a full-term newborn seems to be linked to a lower risk of neonatal transfer to an intensive care unit⁽²⁾.

Caesarean sections are major surgical procedures that carry a number of risks, including long-term obstetric risks like placenta previa and uterine rupture.

They also increase the risk of short-term adverse events in pregnant women, such as increased rates of hemorrhage, transfusions needed, infections, and extended hospital stays, as well as long-term risks in infants, such as increased rates of infection, respiratory complications, and admission to neonatal intensive care⁽³⁾. Asymptomatic to severe pneumonia with acute respiratory distress syndrome (ARDS) and multiple organ failure, which frequently results in mortality, are all possible clinical presentations of COVID-19. The majority of COVID-19 patients experience severe acute respiratory disease, fever, coughing, and shortness of breath. Within the first week, pneumonia usually

develops quickly, and at least one-third of patients also have gastrointestinal symptoms. Compared to severe acute respiratory syndrome (SARS), COVID-19 advances considerably more quickly to respiratory failure and has a higher case fatality rate⁽⁴⁾.

Pre-existing illnesses such chronic lung disease, diabetes, renal failure, and impaired immune systems have been linked to the majority of fatalities, making these people at high risk⁽⁵⁾.

Women who are expecting fall into this high-risk category due to the immunological changes that take place during pregnancy. A COVID-19 infection during pregnancy increases the risk of serious illness and/or fatal results for the mother or the fetus. The pathogenesis of this illness during pregnancy, however, is poorly understood⁽⁴⁾.

In many regions of the world, COVID-19 instances are still increasing dramatically. All gestational ages of pregnant women are included in this rise and are at a higher risk. Although there is some evidence to suggest that vertical transmission is unlikely, the infant must be protected from infection. While we continue to learn more about how COVID-19 affects pregnant women, the management strategies are different due to the limited knowledge about this novel coronavirus, which shares some similarities and distinctions with SARS and Middle East respiratory syndrome (MERS)⁽⁶⁾.

The COVID-19 vaccine was just released, and no specific antiviral therapy is advised. Oxygen therapy is the first step in addressing respiratory dysfunction, and the treatment is symptomatic. Mechanical ventilation, both non-invasive and invasive, may be required in

cases of respiratory failure resistant to oxygen therapy. In order to treat the disease's complex manifestations, intensive care is required ⁽⁷⁾.

The aim of the study was to assess the incidence rate of NICU admission after elective caesarian section in pregnant women admitted to Ain Shams University Hospitals with COVID-19 infection during pregnancy.

PATIENTS AND METHODS

This study was a retrospective cohort study, conducted at Ain Shams University Maternity Hospital from April 2020 to April 2022 and performed on a total of 20 pregnant women who admitted to Ain Shams University Hospitals with COVID-19 during pregnancy documented by polymerase chain reaction test (PCR). Participants were divided into two groups; Group I: Patients infected or who were infected with COVID-19 during pregnancy, and Group II: Patients not infected with COVID-19 during pregnancy. Women in both groups underwent elective Caesarean section (CS) as mode of delivery and their neonates were followed up for need for NICU admission.

The study included pregnant women in whom their age ranged between 20 and 45 years, full term pregnancy (>37 weeks) of gestation with Singleton pregnancy. Being medically free except for occurrence of COVID-19 infection during pregnancy or at any time from 1st to 3rd trimester which were diagnosed either by PCR testing or imaging as Computed tomography (CT) chest and laboratory investigations. In addition to the confirmation of normal foetal morphology by ultrasound scan done during pregnancy and at last delivery was done by elective CS.

Exclusion of Pregnant women who had Pre-term delivery before 37 weeks of gestation with multiple pregnancies, Pre labor rupture of membranes, Any form antepartum haemorrhage, e.g. (Placenta previa and accidental haemorrhage), congenital foetal malformations, any form of antenatal foetal distress, Vaginal delivery and Emergency CS.

All available patients during study duration were included in the study. No sample size was calculated.

All participants were submitted to the following:

History taking including Personal history (Name, Age, Occupation, Residency and Special habits), Obstetric history (Parity, Gestational age, History of previous abortion or deliveries and mode of delivery), Menstrual history, Present history (History of onset, course and duration of any symptoms suggest infection with COVID-19 (Fever, cough, fatigue, loss of taste or smell, bone aches, diarrhea, vomiting, sore throat) and Past history of medical disorders, drug therapy or allergy.

Examination:

- General examination that includes measuring blood pressure, heart rate, body temperature, BMI, and checking the head, neck, bilateral lower limbs, chest, and heart.

- Abdomen Examination: for reveals any surgical scars.

Investigations:

(A) Lab investigations:

- Routine ANC investigations (Rh, CBC, Hemoglobin level, random blood sugar and complete urine analysis.
- Investigation to confirm COVID-19 infection and monitor its severity (PCR of nasopharyngeal swab, CT chest with lead shield, D-dimer levels, serum ferritin, Lactate dehydrogenase levels and, C reactive protein levels).

(B) Imaging by ultrasonography examination to determine gestational age, fetal viability, and the presence of any congenital defects in the fetus.

Outcomes:

Primary outcome NICU admission: Rate of NICU admission after delivery by elective caesarian section in patients infected with COVID-19.

Secondary outcome:

- 1. Maternal outcomes:** (a) Wound infection (purulent wound discharge and fever). (b) Postpartum Sepsis (fever, tachycardia, tachypnea, offensive vaginal discharge after exclusion of DVT, chest infection, wound infection and Urinary tract infections). (c) Need for ICU admission and mechanical ventilation (fever, cough, shortness of breath, Oxygen saturation > 90%).
- 2. Fetal outcome:** (a) APGAR score at 1-min and 5-min. (b) Fetal Sepsis (fever, tachycardia, tachypnea, calmmy and pale skin). (c) Fetal Weight. (d) Neonatal SARS-COV.2 infections (vertical transmission) (Nasal Swab for covid-19).

Ethical consent:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Ain Shams University. Written informed consent was obtained from all participants. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Qualitative data were described using number and percent. Quantitative data were described using median (minimum and maximum) and inter quartile range for non-parametric data, and mean and standard deviation (SD) for parametric data after testing normality using Kolmogrov-Smirnov test. The independent student's t-test and the mean difference and its 95% confidence interval (CI) (for numeric

parametric variables) or the Chi-squared test and the risk ratio and its 95% CI are to be used to assess differences between two independent groups (for categorical variables).

For determining the relationship between an excellent or poor response and the measured variables, binary logistic regression analysis was carried out. For determining if measured variables are valid as indicators of an appropriate or inappropriate response, ROC curves was built. Sensitivity, specificity, positive and negative predictive values, and their related 95% confidence intervals were used to present validity. P value ≤ 0.05 was considered significant.

RESULTS

In this study, eligibility for 26 patients was determined, and 20 individuals were enrolled (10 in each group). Six of the eligible patients were not included in the study because they did not meet the inclusion criteria.

In the end, the study was based on 20 pregnant women who were divided into two groups; *Group I*, which had 10 pregnant women who were infected with COVID-19 or who had been throughout pregnancy, and *Group II*, which contained 10 pregnant women who had not been infected with COVID-19.

With regard to maternal age, parity, and gestational age, the current study found no statistically significant differences between the analyzed groups (P values 0.629, 0.301 and 0.255, respectively).

As regards clinical presentation, this study results revealed that fever and cough were the most frequent clinical presentation (80% for each) followed by dyspnea.

Regarding neonatal outcome and morbidities, these results revealed that birth weight statistically was non significantly lower among COVID-19 group (P value 0.93), whereas APGAR scores at 1 and 5 minutes statistically were non-significantly lower among COVID-19 group with no statistically significant differences between the studied groups regarding NICU admission (P value 0.47).

As regards NICU admission, the results of the current study revealed that maternal age was lower in mothers of neonates that needed NICU admission (P value 0.009) and respiratory presentations (fever, cough, dyspnea, chest pain and desaturation) were more frequent in mothers of neonates that needed NICU admission. Hemoglobin and TLC were lower in mothers of neonates that needed NICU admission.

Table 1 shows that APGAR scores were more frequent among COVID-19 group. NICU admission was more frequent among COVID-19 group.

Table (1): Neonatal outcomes among the studied groups

Outcomes		COVID-19 (N=10)	Control (N=10)	P-value
Birth weight (kg)	Mean \pm SD	2.8 \pm 0.4	2.8 \pm 0.3	$\wedge 0.934$
	Range	2.2 - 3.6	2.2 - 3.2	
APGAR-1	Mean \pm SD	6 \pm 1.5	6.9 \pm 0.9	$\wedge 0.195$
	Range	4 - 9	5 - 8	
APGAR-5	Mean \pm SD	8.4 \pm 1.3	8.9 \pm 0.3	$\wedge 0.281$
	Range	6 - 10	8 - 9	
COVID-19 infection		0 (0.0%)	0 (0.0%)	NA
Sepsis		0 (0.0%)	0 (0.0%)	NA
NICU admission		2 (20.0%)	0 (0.0%)	#0.474
Mortality		0 (0.0%)	0 (0.0%)	NA

\wedge Independent t-test. #Chi-squared test. CI: Confidence interval. *Significant. Relative effect: Effect of COVID-19 relative to control.

Table 2 shows that wound infection and postpartum hemorrhage were more frequent among COVID-19 group. Postpartum sepsis was not recorded in the study groups. Maternal ICU admission and mortality were higher in COVID-19 group (P<0.001).

Table (2): Maternal outcomes among the studied groups

Morbidities	COVI D-19 group (N=10)	Control group (N=10)	P-value	Relative risk 95% CI
Wound infection	1 (10%)	0 (0%)	#0.826	1.09 (0.50–2.37)
Postpartum hemorrhage	1 (10%)	0 (0%)	#0.772	1.67 (0.41–6.81)
Postpartum sepsis	0 (0.0%)	0 (0.0%)	Not applicable	
ICU admission	8 (80%)	0 (0.0%)	<0.001	
Maternal Mortality	5 (50%)	0 (0.0%)	<0.001	

#Fisher’s exact test.

DISCUSSION

A highly contagious illness known as the novel coronavirus disease (COVID-19) was first identified in December 2019 in Wuhan, Hubei Province, China.

In just a few weeks after the disease first appeared, it had already spread to multiple nations. In January 2020 and March 2020, the WHO proclaimed the outbreak to be a pandemic and a public health emergency of international significance ⁽⁸⁾.

Studying the impact of COVID-19 on maternal and neonatal outcomes was emphasized as a key area of research because COVID-19 infection during pregnancy represents a significant conflict and is

frequently associated with bad maternal and neonatal outcomes in pregnant individuals ⁽⁹⁾.

There isn't enough analytical research to compare the effects of COVID-19-infected and non-infected pregnancies on the mother and the foetus, despite the high number of pregnant women with the coronavirus illness 2019 (COVID-19) that has been identified ⁽¹⁰⁾.

Consequently, this study aimed to assess the incidence rate of NICU admission after elective caesarian section in pregnant women admitted to Ain Shams University Hospitals with COVID-19 infection during pregnancy.

In order to determine the impact of COVID-19 on pregnancy and neonatal outcomes, **Antoun et al.** ⁽⁹⁾ conducted a prospective cohort research in a sizable tertiary maternity center that involved 23 pregnant patients, including singleton and multiple pregnancies tested positive for COVID-19.

With 1-min Apgar scores of 8-9 and 5-min Apgar scores of 9-10, which show no effect on APGAR score, the majority of neonates (95%) did not require resuscitation, according to **Antoun et al.** ⁽⁹⁾ his results agreed with the results of our study.

In order to compare the effects of symptomatic COVID-19 virus infection on the mother and foetus with those of non-infected pregnant women, **Pirjani et al.** ⁽¹⁰⁾ conducted a prospective cohort study that enrolled 199 women, including 66 COVID-19 infected and 133 non-infected pregnant women prospectively. Their findings were comparable to those of the current study in that there were no notable differences between the two groups for key newborn outcomes such preterm birth, low birth weight, NICU hospitalization, neonatal sepsis, and APGAR score at one and five minutes.

In the same line, **Akbarian-Rad et al.** ⁽¹¹⁾ conducted a retrospective cohort research with eight neonates delivered to COVID-19-positive pregnant women who were more than 37 weeks along in the pregnancy to evaluate short-term outcomes and symptoms among neonates of COVID-19 positive moms.

In agreement with the findings of this study, **Akbarian-Rad et al.** ⁽¹¹⁾ reported that all neonates had Apgar scores of 8 or 9 out of 10 in the first and fifth minutes, respectively, and that none of the infants needed to be revived in the delivery room. Newborns weighed \pm 697 gram at birth.

According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, **Smith et al.** ⁽¹²⁾ conducted a systematic review that included nine articles with 92 pregnant women that were eligible for inclusion in order to provide clinicians with more information about the maternal and neonatal effects of COVID-19 during pregnancy and to aid in making well-informed decisions.

On the contrary to the results of this study, **Novoa et al.** ⁽¹³⁾ revealed that low birth weight was significantly reported in 60% of newborns delivered to mothers infected by COVID-19 and all patients had preterm

delivery in a study which included larger sample size of 322 infected pregnant women. However, this study had strong point of assessing the correlation between COVID-19 infection and wound infection after elective cesarean section that not assessed by previous studies.

These results were in concordance with the data reported by **Pirjani et al.** ⁽¹⁰⁾ in which no significant association was found between COVID-19 infection and postpartum infection.

Antoun et al. ⁽⁹⁾ revealed no significant maternal complications of postpartum hemorrhage or sepsis which was in agreement to the results of this study where both assessed the effect of COVID-19 regarding postpartum sepsis but not on a large number of patients.

Strength of the study:

The study's strengths included its retrospective study design, no patients lost to follow-up during the study, relatively large sample size in comparison to some other prior studies, multicentricity, and significant low risk of publication. It was also the first study in Ain Shams Maternity Hospital to compare maternal and fetal outcomes between patients infected by the Covid-19 virus with non-infected pregnant women.

LIMITATIONS OF THE STUDY

It is important to note the study's limitations, which include the fact that it was retrospective in nature, which may have resulted in clinical data on patients being missed, the study's brief duration, and the fact that few participants gave birth, which limited our ability to draw conclusive conclusions about obstetric and neonatal outcomes.

CONCLUSION

There were no changes in the APGAR score, NICU hospitalization, wound infection, postpartum hemorrhage, or sepsis between pregnant women with and without COVID-19 infection. As a result, the clinical features of COVID-19 in pregnant patients and newborns appear to be the same as those in infected individuals who are not pregnant. Sadly, there is still insufficient proof of the COVID-19 virus during pregnancy.

These results support the need for additional cohort studies to assess the relationship between COVID-19 infection and prenatal and neonatal outcomes taking into account the effects of numerous potential factors, including the severity of maternal infection, the amount of time between the onset of symptoms and childbirth, and the sufficiency of the placental blood supply.

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