

ORIGINAL ARTICLE

CLINICAL OUTCOMES OF COVID-19 POSITIVE MOTHERS AND THEIR NEWBORNS – A RETROSPECTIVE STUDY

Diana H. Silva, Anaísa Afonso, Ana Gomes Silva, Ana Gomes Silva, Ana Póvoas.
Serviço de Pediatria, Centro Hospitalar de Setúbal, EPE - Setúbal, Portugal.

ABSTRACT

Aim: To determine the outcomes of COVID infection in pregnant women and their babies during the neonatal period and for their first 6 months of life; to acknowledge the impact of room-in policies in breastfeeding.

Methods: Retrospective cohort study conducted over an 8-months period in a level II hospital, in Portugal. Eligible patients were mothers with SARS-CoV-2 infection and their newborns admitted to our hospital.

Results: During the study period, a total of 865 deliveries took place. 5.9% (n=51) of these mothers tested positive for SARS-CoV-2 during pregnancy, 72.5% being positive on admission.

There were 52 infants for analysis, with median gestational age of 38.6 weeks. 11.5% (n=6) were preterm (lower birth age: 32 weeks), 11.5% (n=6) had low birth weight, 13.5% (n=7) were light for the gestational age. There were no fatal outcomes. Median length hospital stay was 3.7 days. 73.5% (n=25) were admitted in the Neonatal Care Unit, 80% (n=20) due to lack of hospital policies to allow room-in. None of the infants tested positive for SARS-CoV-2 prior to discharge nor during follow-up.

Before rooming-in was allowed, 42 babies were born to COVID+ mothers. Only 45.2% (n=19) of these were breastfed at the time of the discharge. After hospital policies changed, another 10 infants were born, 90% being breastfed at the time of the discharge.

Conclusion: Our study demonstrates that both perinatal and postnatal transmission are unlikely. Also, it highlights importance of rooming-in to promote breastfeeding.

Introduction

The coronavirus SARS-CoV2 was first declared as a global pandemic in early March 2020 by the World Health Organization. Since then, many discoveries about this virus have been made and many hospital policies have changed in light of the most recent data. Nowadays, data suggests that children tend to have mildly symptomatic or asymptomatic COVID infection. However, the lengths of the COVID infection in neonates whose mothers tested positive during the prenatal and perinatal periods is unknown. Therefore, it is important to keep a close follow-up of these newborns in their first months of life.

Since the beginning of the pandemic, hospitals had to reorganize their policies for suspected and confirmed COVID patients. Until April 2021, our hospital, a level II hospital near Lisbon, Portugal, was not able to allow room-in due to the lack of hospital facilities.

This study aimed to determine the outcomes of COVID infection in pregnant women and their babies during the neonatal period and for their first 6 months of life. It also aimed to acknowledge the impact of the room-in policies in breastfeeding.

Address for Correspondance: Diana H. Silva, Rua Camilo Castelo Branco, Aptd. 140, 2910-446 Setúbal, Portugal.

Email: dianahdasilva@gmail.com

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ABBREVIATIONS

WHO - World Health Organization; COVID-19 - Coronavirus disease 2019; BMI - Body mass index; P1 - Period 1; P2 - Period 2; P3 - Period 3.

Methods & Materials

This retrospective cohort study was conducted in Centro Hospitalar de Setúbal, a level II hospital, in Setúbal-Portugal; which has approximately 1560 deliveries per year.

Eligible patients were mothers with SARS-CoV-2 infection admitted from November 2020 until late June 2021 and their newborns. Before November 2020, the hospital transferred all pregnant women that tested COVID positive to a level III hospital.

At study onset, PCR testing was mandatory for all admitted patients. This test was repeated at any point during hospitalization, if they had a previous negative test but reported symptoms of SARS-CoV-2 or had close contact with people with these symptoms in the previous days. Mothers were not allowed to have visits during their hospitalization. Due to the hospital infrastructures and the high number of COVID patients admitted, rooming-in was not possible until April 2021. Before that, mothers that tested positive at the time of birth were isolated to prevent transmission and their newborns were admitted in the neonatal care unit. To promote breastfeeding, mothers were encouraged to pump.

After April 2021, it was possible for asymptomatic or mildly symptomatic COVID positive mothers to room-in with their newborns. Breastfeeding among these mothers was encouraged and supported, reinforcing the need to use masks and handwashing.

Testing polices changed during the study period regarding the time of execution: initially it was done in the first 4 hours after birth and upon discharge; since April 2021, it is done in the first 24 hours after birth and at discharge.

During the study period, delta variant was the most prevalent the COVID strain in Portugal, but COVID strain differences were not considered in this study.

Newborns of positive mothers were usually discharged with their mother. Upon discharge mothers were advise to keep wearing a mask while providing for their newborns, specially while breastfeeding, until their 14th days of life.

Newborns were usually discharged 48-72 hours after vaginal birth and 72 hours after caesarean. For these newborns it was established a follow-up program with periodic phone calls. These calls were made by a Pediatrician and were used as a way to assess if the newborn had developed any symptoms of COVID and if so, if medical observation was required. Most contacts were done every 3 days post-discharge until 21 days of life. All these calls had a standardized template and were documented in the patient medical file.

The medical records of infants who met study criteria were reviewed (including data from calls with reports of infant symptoms). We also reviewed records from any presentations to care at any of public hospital within six months of discharge, including reason for presentation, clinical interventions, laboratory and other diagnostic testing and diagnosis.

Our outcomes were to assess: 1. any possible sequelae of the COVID infection of the mothers; 2. the risk of developing COVID-19 infection among newborns (defined by developing symptoms and having a SARS-CoV2 positive test); 3. infants who developed any symptoms during the neonatal period or afterwards; 4. number of times infants had to recur to the emergency department. Study data were collected using SClinic®, Alert® and notes from calls (as previously stated). Analyses were performed using Statistical Package for the Social Sciences (SPSS®) software v.22.0. We performed descriptive analyses using categorical variables and medians, means, and simple ranges for continuous variables. Normal distribution was checked using Shapiro-Wilk test or Skewness and kurtosis.

Results

During the 8-month study period, a total of 865 deliveries took place at our hospital. 5.9% (n=51) mothers tested positive for SARS-CoV-2 during pregnancy, 72.5% (n=32) were positive on admission (11 symptomatic and 26 asymptomatic) (Figure 1). There were 52 infants for analysis.

Figure 1. Mothers that tested COVID positive during pregnancy: COVID positive test on hospital admission/ before hospital admission distribution.

72.5% (n=32) COVID+test on hospital admission	27.5% (n=19%) COVID + before
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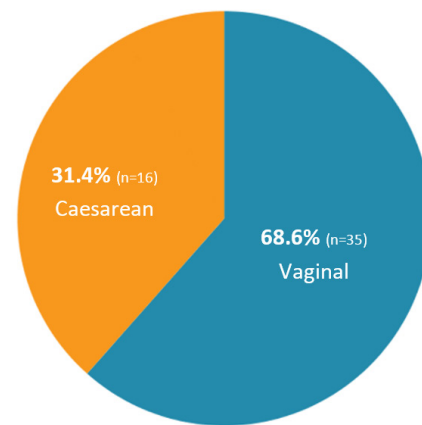
Figure 2. Mothers that tested COVID positive during pregnancy: Symptomatic/asymptomatic distribution.

39.2% (n=20) symptomatic	60.8% (n=31) ssymptomatic
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Amongst the mothers that tested COVID positive during pregnancy, 39.2% (n=20) of the mother were symptomatic (Figure 2). Of all the mothers that had symptoms, only one tested positive during the first trimester of pregnancy. All the others tested positive during the third trimester. Most of the mothers had only mild symptoms, such as cough, nasal congestion, myalgia, anosmia, fever and headache. Nonetheless, 4 mothers needed hospital admission exclusively due to COVID symptoms, 2 in an intensive care unit due to respiratory failure.

68.6% (n=35) of the mothers had a vaginal birth vs 31.4% (n=16) that had a caesarean (Figure 3). However, only one caesarean occurred due to mother illness (respiratory failure with remarkable hypoxemia) and another one due to fetal distress, all the others were due to pelvic presentation or previous recent caesarean.

Figure 3. Distribution by type of labor.



Of the 52 newborns, 61.5% (n=32) were male. Median gestational age was 38.6 weeks; 11.5% (n=6) were preterm (lower birth age: 32 weeks), 11.5% (n=6) had low birth weight, 13.5% (n=7) were small for the gestational age, 17.3% (n=9) had a head circumference percentile <10 and 23.1% (n=12) had a length-for-age percentile <10 (Table 1).

Table 1. Demographic and Clinical Characteristics of the newborns of positive mothers.

Characteristic	Results
Sex	61.5% (n=32) male
Gestational age	Median: 38.6 weeks Minimum: 32 weeks
Preterm	11.5% (n=6)
Low birth weight	11.5% (n=6)
Small for the gestational age	13.5% (n=7)
Head circumference P<10	17.3% (n=9)
Length-for-age P<10	23.1% (n=12)
Fatal outcome	0
Length hospital	Median: 3.7 days Maximum: 16 days
Neonatal Care Unit admission	65.4% (n=34)

During hospital stay, 21.2% (n=11) presented feeding difficulties, 15.4% (n=8) respiratory distress such as tachypnea, polypnea and hypoxia: 1 needed mechanical ventilation, 1 needed high nasal flow cannula, 2 needed

mild O2 supplementation by nasal cannula, and the other 4 had periods of polypnea without hypoxia.

Due to risk of infection, 8 newborns had a septic evaluation. 3 of those had an increase of the inflammatory markers (with Protein C Reactive >2-4mg/dL). These infants were treated with antibiotics and never tested positive for COVID.

14.7% (n=5) failed to pass the neonatal hearing screening test and were referred to Otolaryngology. Later evaluation showed no earing problems amongst these infants. None failed the congenital cyanotic heart disease screening.

There were no fatal outcomes. All the babies were discharge until the 16th day; the median length hospital stay was 3.7 days (Table 1). 65.4% (n=34) were admitted in the Neonatal Care Unit, 85,3% (n=29) due to lack of hospital policies to allow room-in.

Until the 6th month of our study were born 42 babies from COVID+ mothers, however, only 45.2% (n=19) of these were breastfed at the time of the discharge. Afterwards, with the change of hospital policies and the possibility of rooming-in, 10 infants were born. Of these, only 2 needed admission in the Neonatal Care Unit (1 due to maternal admission in the ICU). 90% (n=9) of the infants of this later group were breastfed at the time of the discharge (Table 2).

Table 2. Comparison between study periods – before vs after hospital policies allowing rooming-in.

	First 6 months of the study period	Last 2 months of the study period
Newborn babies from COVID+ mothers	42	10
Neonatal Care Unit admission	76,2% (n=32)	20% (n=2)
Breastfeeding at the time of the discharge	45.2% (n=19)	90% (n=9)

All newborns of COVID positive mothers at the time of birth (n=38) were tested twice for SARS-CoV-2 by nasopharyngeal PCR prior to hospital discharge. 97% (n=37) had both tests negative. Only one had a positive test (at 20 h of life). However, the infection was not confirmed because a second PCR test repeated at 48h of life was negative. Also, this infant was always asymptomatic throughout hospitalization and neonatal period.

Only one infant was admitted to the NICU due to respiratory failure: a 33-week preterm baby, who needed mechanical ventilation. However, he never tested positive to SARS-CoV-2 (nasopharyngeal and bronchoalveolar lavage) and, within 8 days, his symptoms improved and was discharged after 3 weeks (prolonged length of stay due to feeding difficulties).

All the 30 infants born to positive mothers at the time of birth maintained a phone follow-up for 21 days, in which a total of 8 failed to successfully establish all the predicted number of phone calls (but were still included in this study). Only 1 infant was lost to follow-up. 7.8% (n=4) of the newborns reported symptoms after discharge at follow-up calls: 2 had cough, 1 nasal

congestion and 1 myoclonus. This last baby was later diagnosed with tuberous sclerosis.

All the newborns included in our study had their medical record reviewed at 6 months of life. Only 2 had Emergency Department (ED) visits within the Portuguese hospital public service during the first month of life, none of them due to COVID infection (1 esophageal reflux and 1 respiratory distress without hypoxia, that tested negative for COVID). At 3 months of life only 4 infants have had an ED visit: 1 due to pyloric stenosis and 1 acute bronchiolitis without hypoxia and with a negative COVID test.

At 6 months of life a total of 21 infants had had ED visits (a maximum of 5 visits): 12 of them due to respiratory symptoms, but none needed hospital admission. During follow-up 3 babies were diagnose with congenital malformations: 1 with tuberous sclerosis (with TSC1 mutation); 1 with a left upper limb hypoplasia without apparent neurological involvement, and another one with an interatrial communication and right heart dilation.

Discussion

We present a cohort of SARS-CoV-2-exposed infants either during pregnancy or perinatal period, which were followed up for six months after birth.

Pregnancy is considered a risk factor for moderate to severe covid infection.^{1,2,3,4} However, most of the mothers COVID+ included on our study had mild symptoms or no symptoms at all. Only 4 mothers needed hospital admission exclusively due to COVID symptoms, 2 ended-up being admitted in an intensive care unit due to respiratory failure.

COVID infection during pregnancy is believed to be more dangerous for the mother than for the baby.⁵ Nonetheless, it is important to identify any possible infection during each pregnancy period, as we still lack enough data about medium to long term sequelae for the baby.

As Setúbal became one of the most affected areas in Portugal due to coronavirus infections, our hospital saw many COVID patients and became overwhelmed with patient influx. That led the hospital to redefine strategies to be able to take care of the infected mothers and their newborns.

Newborn outcomes showed no statistical difference from the general population. Contrary to some studies, our study population did not show an increase in the preterm rates. Also, the infants included in this study did not present increased risk of any form of respiratory distress.

According to national⁷ and international guidelines⁸, all infants of positive mothers at the time of birth were tested⁹ twice for SARS-CoV-2 by nasopharyngeal PCR prior to discharge, none was positive on the second test.

After hospital discharge, we used a standardize chart based on the mothers' reports during the follow-up calls and electronic medical records to determine presentations to any emergency department around the country in order to determine if an infant had developed any symptoms attributable or related to COVID-19.

Phone calls follow-up presented an opportunity to keep in touch with the newborns families in more than 96%

of the cases. By doing that we were able to reduce placing other patients at risk while still providing medical advice for these families.

Our study suggests that transmission between mother and baby during the perinatal period is unlikely. It also reinforces that the horizontal transmission during the postnatal period is unlikely, as the most recent studies have been suggesting.^{11,12,13,14}

After being discharged, none of the babies that were tested for COVID had a positive test. During the first 21 days of follow-up, 4 newborns presented mild symptoms, but none was suspected to be COVID, nor had a positive test result. None of the infants required hospitalization during the study period.

Only 2 were observed in the emergency department during the first month of life, none of them COVID positive. During the first 3 months of life other 2 were observed in the emergency department, none of those were considered to be due to COVID infection. At 6 months of life a total of 21 infants had had ED visits (a maximum of 5 visits/per baby, most of them with less than 2 visits) and none needed hospital admission. Also, during follow-up 3 babies were diagnosed with congenital malformations, nonetheless our data is not enough to establish a link between the congenital abnormalities and covid infection during pregnancy. Additionally, this study lacked a formal assessment of the physical growth and psychosocial development during follow-up.

Antibody status for both mother and babies were not performed.

Recommended practices^{7,15}, since the first months of the pandemic, were to allow-rooming in. The risk of infection transmission mother-baby during pregnancy or on the neonatal period seems to be very low.^{11,12,13,14,15,16,18} Besides that, there are numerous well-known benefits of allowing room-in for mother-baby wellness (such as improving bonding and breastfeeding).^{18,19,20} However, due to the huge influx of COVID patients during the first year of the pandemic, only in the beginning of April 2021, our hospital was able to allow the infants of asymptomatic or mildly symptomatic mothers to room-in with their mothers. Room-in policies included putting the newborn in an open crib, two meters away from their mother bedside and mothers were advised to wear mask while providing for their baby.^{7,17}

This study allows both a comparison between separation and room-in policy outcomes, especially on breastfeeding. Before the room-in was allowed, only 45.2% of the newborns were breastfed at the time of the discharge. This increased up to 90% after the change of policy. This demonstrates the importance of these practices to promote breastfeeding and the need to acknowledge the room-in benefits.¹⁵

During our study, we were presented with several limitations: First, the number of newborns eligible for this study was smaller than predicted, especially considering the hospital area as a high risk covid zone for such a long time.²⁰ This could be due to many factors, including: asymptomatic or mildly symptomatic mothers might be less likely to report the COVID infection. Asymptomatic mothers are also less likely to

get tested for COVID, except upon hospital admission due to the mandatory health care policies. Also, since our hospital did not allow room-in for some time, some COVID+ mothers at the time of labor may have looked for other health facilities that allowed this policy, reducing our study group. Second, infant symptoms following hospital discharge were self-reported by their parents, which may have led to a recall bias. We tried to reduce this bias by reviewing charts provided by public hospitals nationwide, however, some of these babies may have been followed in private institutions, in which cases the clinical data is not accessible to us. To summarize, as long as the pandemic continues, hospitals will continue to care for numerous expectant mothers who test positive for SARS-CoV-2. Due to this, it is important to know what this result may implicate for every newborn and what can we do to minorize effect, especially in the long run.

Compliance with Ethical Standards

Funding None

Conflict of Interest None

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