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Clinical outcomes in newborns of pregnant women affected by respiratory infection due to COVID-19

Desfechos clínicos em recém-nascidos de gestantes acometida com infecção respiratória-COVID-19

Resultados clínicos en recién nacidos de mujeres embarazadas afectadas por infección respiratoria: COVID-19

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ABSTRACT

Objectives: To describe the clinical outcomes in newborns of pregnant women diagnosed with COVID-19. Methodology: This is an observational and retrospective field research, with a cross-sectional design, conducted in a public reference maternity hospital. The sample consisted of 191 medical records of women who had a diagnosis of COVID-19 at the time of delivery, from March 2020 to March 2021. Results: Most pregnant women were in their first and second pregnancies (29.32% and 31.94%, respectively), with the age group of 29 to 33 years representing 24.60%. A total of 25 pregnant women had previous abortions, while 16 underwent uterine surgery. Diabetes was observed in 25 pregnant women and hypertension in 34. There were 92 cases of Flu Syndrome identified and 14 hospitalizations due to pre-eclampsia. Regarding the Apgar evaluation, most newborns scored from 7 to 10 (86.39%), indicating good vitality. The term category included 64.40% of newborns, and 178 newborns were discharged. Conclusion: In light of the pandemic scenario and the uncertainties generated by COVID-19 infection during pregnancy, it is essential to maintain surveillance and systematic monitoring of maternal and neonatal conditions. Thus, the importance of continuous production of scientific evidence that supports clinical decisions and public policies aimed at maternal and child health should be reinforced, especially in situations of health emergencies, pandemic evolution, and the emergence of variants. It is essential to continue monitoring outcomes to support clinical practices and public health policies, ensuring safe pregnancies and births in the face of this challenging global situation.

DESCRIPTORS

Infant, Newborn. COVID-19. Pregnant Women.

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INTRODUCTION

In Brazil, the confirmation of the first case of COVID-19 occurred on February 26, 2020. From January 2020 to February 2021, deaths from COVID-19 accounted for 16% of the total number of casualties in Brazil. In 2021, considered the deadliest year, there was a significant increase in the number of recorded deaths in the country, totaling 411,044 cases by December 31[1].

In the year 2022, in Brazil, a total of 6,189 confirmed cases of Severe Acute Respiratory Syndrome (SARS) in pregnant women were recorded, of which 60% were caused by COVID-19. In this context, the highest reports occurred in the third trimester of pregnancy, accounting for 70.6% of the confirmed cases. Furthermore, of the 3,719 confirmed cases of COVID-19 in that trimester, 38 resulted in death. In contrast, at the start of the pandemic, in 2020, the number of deaths of pregnant women with COVID-19 was 291, which represents a 600% increase compared to the following years[2].

According to information from the State Health Department of Piauí, the initial record of a confirmed case of COVID-19 in the state occurred on March 19, 2020. The most affected municipality is the capital, Teresina, which recorded 1,327 infected individuals, accounting for 54.38% of the total amount. In terms of deaths, the municipality also reported the highest number, reaching 40 deaths due to COVID-19, which represents 47.05% of all records in the state[3].

Thus, it is considered that the average incubation period of SARS-CoV-2 is approximately five days; and, among the commonly observed symptoms, one can mention: fever, dry cough, myalgia, headache, and diarrhea. In more severe cases, dyspnea may occur on average eight days after the onset of symptoms. Changes in routine tests have also been observed, such as blood counts, with leukopenia, lymphopenia, and thrombocytopenia commonly found[4-5].

Physiological changes inherent to pregnancy may characterize pregnant women as a group with a higher risk for SARS-CoV-2 infection, similar to greater susceptibility to the development of diabetes mellitus and other viral infections. Infection can occur at any stage of pregnancy, bringing different effects on the mother and fetus, depending on the gestational moment in which contamination occurs. In pregnant women confirmed to have COVID-19 in the third trimester, newborns (NBs) may develop active infection, leading to an increased risk of adverse outcomes and becoming potential transmitters to healthcare professionals and caregivers[6-7].

When infected by SARS-CoV-2, these women have a higher risk of developing pre-eclampsia, severe infections, the need for hospitalization in an Intensive Care Unit (ICU), premature rupture of membranes (PROM), preterm birth, fetal distress, maternal mortality, perinatal mortality, neonatal morbidity, and a severe risk of vertical transmission of the disease[1].

In children and neonates, the disease manifests asymptomatically or with mild cases, which have a rapid recovery and a better prognosis. Accordingly, there is a low incidence of severe cases and deaths compared to cases in adults[8-10]. In a descriptive and ecological study conducted in nine states of the Brazilian Northeast, with a sample of 23,835,722 children and adolescents aged 0 to 19 years, it was observed that, from March to August 2020, 74,705 cases of COVID-19 were confirmed in this population, with 175 deaths in the age group from 0 to 9 years[11].

Thus, the lack of sufficient data on the vertical transmission of SARS-CoV-2 does not allow for the confirmation of its occurrence. Nonetheless, isolated reports have been gaining importance for analysis, such as in the case of the identification of IgG and IgM antibodies in newborns of mothers infected with the COVID-19 virus[12-13].

In a literature review conducted by Weffort et al. (2020), cases of perinatal transmission were described, but the authors highlighted the lack of clarification on whether the transmission occurred via transplacental route or environmental exposure. They also emphasized the need for more in-depth studies on the topic. Therefore, despite the implementation of stringent preventive measures to avoid maternal-fetal transmission, the lack of studies related to neonatal outcomes undermines the adoption of appropriate management practices[13-14]. In light of the above, the objectives of this study are to describe the clinical outcomes in NBs of pregnant women diagnosed with COVID-19.

METHODS

This study is part of a PIBIC-Af/CNPq 2022/2023. This is an observational and retrospective field

research, with a cross-sectional design. It is an observational study with a cross-sectional design, retrospective approach, and descriptive nature, with the objective of exploring clinical and obstetric aspects in pregnant women diagnosed with COVID-19[15-16].

The research was conducted in a public maternity hospital, linked to education and research, located in a capital city of the Brazilian Northeast. The institution is considered a reference for high-complexity care for pregnant women and newborns, having 248 maternal beds and 167 neonatal beds, offering outpatient care, complementary exams, urgent and emergency services, as well as hospitalizations. In addition, one of its institutional guidelines is the encouragement of scientific production to improve the provided care, and it holds the title of Baby-Friendly Hospital, granted by the United Nations Children's Fund (UNICEF)[17].

The study population consisted of records of women who had a confirmed diagnosis of COVID-19 at the time of delivery, from March 2020 to March 2021. In order to define the sample in a finite population, stratified by percentage, the following statistical parameters were adopted: a confidence level of 95%, a sampling error of 5%, and an estimated prevalence of 37.7%. The calculation resulted in a sample composed of 191 medical records.

The study included the records of newborns whose mothers were confirmed to have a diagnosis of COVID-19 during labor, regardless of the presence of neonatal infection. Records were excluded where the mothers did not undergo testing for COVID-19 at the time of delivery and those with incomplete information on neonatal clinical outcomes.

$$n = \frac{N.Z^2.p.(1-p)}{Z^2.p.(1-p) + e^2.(N-1)}$$

Initially, 865 COVID-19 tests were identified as part of the evaluation process for admission to the maternity ward. After screening, an eligible population of 208 medical records was obtained. Based on the application of the sampling formula with a finite population, adopting a confidence level of 95%, a sampling error of 5%, and a prevalence of 37.7%, a final sample composed of 191 medical records was reached.

The inclusion criteria were established as the medical records of newborns whose mothers had a confirmed diagnosis of COVID-19 infection during labor, regardless of whether the newborns were contaminated or not. The exclusion criteria included the medical records of pregnant women who did not undergo the COVID-19 test at the time of delivery and the medical records that contained incomplete information related to neonatal clinical outcomes.

Additionally, 234 medical records that were not located, 128 records that did not contain essential clinical data, and 295 records corresponding to consultations that did not result in delivery were excluded from the analysis, such as outpatient visits, high-risk prenatal follow-ups, intrauterine device insertions, and short consultations without obstetric follow-up.

The data collection was carried out from May to June 2023 through a questionnaire developed by the authors themselves. Initially, before starting the data search, the instrument in question was submitted to a pre-test, developed based on the variables available in the medical records, in February 2023, in order to verify relevant aspects and make the required adjustments to obtain information that corresponded to the objectives of the study.

The form sought information regarding the following variables: number of current pregnancy, type of delivery, mother's age, obstetric history, reason for current hospitalization, clinical manifestations associated with COVID-19, sex of the NB, gestational age at birth, Apgar score, clinical manifestations of the NB, and clinical outcome. It should be emphasized that a blinding strategy was adopted during data collection, so that the form did not contain personal identification of the patients nor did it allow the evaluator to know in advance the clinical outcome of the newborns when filling out the instrument. This measure aimed to reduce information bias and ensure greater impartiality in the collection and recording of data.

The collected data was initially entered in a Microsoft Excel spreadsheet and later analyzed using the statistical software SPSS (Statistical Package for the Social Sciences). Simple measures, such as frequency distribution and percentages, were used for statistical analysis.

The research protocol was approved by the Research Ethics Committee (REC) of the Federal University of Piauí (UFPI), under opinion nº 5.254.342 and CAAE nº 51036321.0.0000.5214. It is underlined

that the authors signed the Data and Medical Records Use Agreement Term (TCUD) and the Confidentiality Term.

RESULTS

The records of a total of 191 pregnant women who tested positive for COVID-19 were analyzed. Table 1, in turn, shows the descriptive characteristics intrinsic to this group of pregnant women. Concerning the number of previous pregnancies, a varied distribution is observed. Most pregnant women are in their 1st and 2nd pregnancies, with 29.32% and 31.94%, respectively. The number of pregnancies decreases as the number of previous pregnancies increases, with 21.99% in the 3rd pregnancy, 12.04% in the 4th pregnancy, 84.19% in the 5th pregnancy, and only 0.52% in the 6th pregnancy.

As regards the age range of pregnant women, a diverse distribution was evident. The group aged 29 to 33 years represents the highest percentage, with 24.60% of pregnant women. Right behind, the age ranges of 19 to 23 years and 24 to 28 years are equally significant, with 24.08% and 21.99%, respectively. When it comes to the mode of delivery, there was a notable predominance of cesarean section, accounting for 79.06% of cases. In contrast, a smaller proportion of pregnant women had vaginal deliveries, totaling 20.94%.

Table 1. Descriptive characteristics of pregnant women diagnosed with COVID-19 (n= 191). Teresina, Piauí, Brazil, 2023.

PREGNANT WOMAN PROFILE	N	(%)
Pregnancy (including current pregnancy)		
1st pregnancy	56	29.32
2nd pregnancy	61	31.94
3rd pregnancy	42	21.99
4th pregnancy	23	12.04
5th pregnancy	8	4.19
6th pregnancy	1	0.52
Age group		
14-18	16	8.38
19-23	46	24.08
24-28	42	21.99
29-33	47	24.60
34-38	32	16.75
39-45	7	3.66
46-50	1	0.54
Type of delivery (current pregnancy)		
Cesarean section	151	79.06
Natural birth	40	20.94

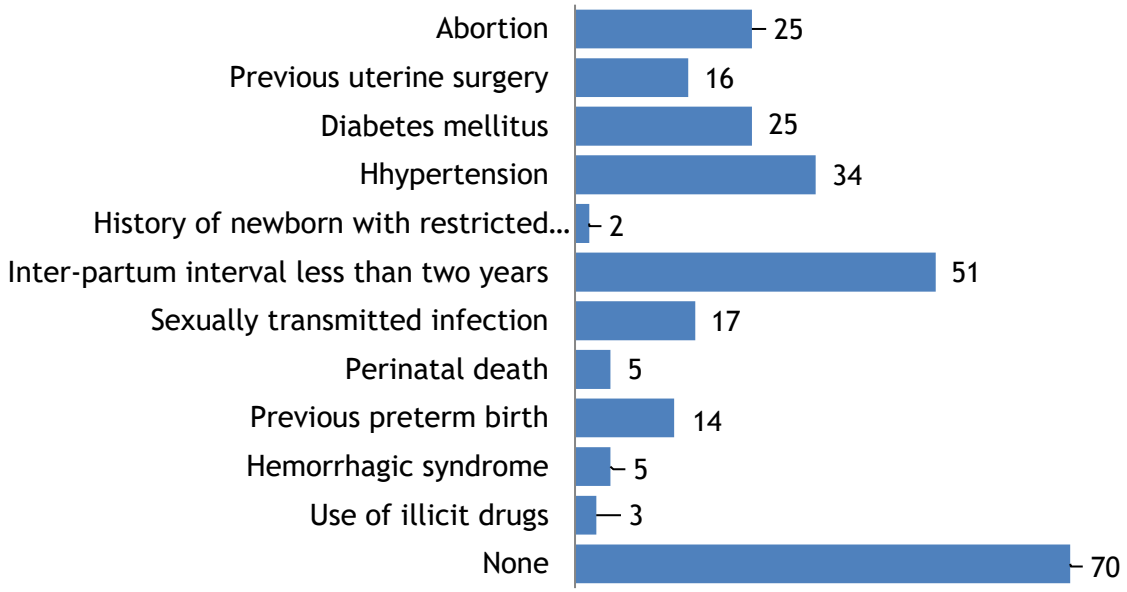
Source: authors, 2023.

The analysis of the obstetric history of pregnant women revealed relevant information. A total of 25 women had a history of previous abortions, while 16 women had undergone uterine surgery. The presence of diabetes mellitus was observed in 25 pregnant women, and hypertension was identified in 34 pregnant women. Two cases had a history of newborns with growth restriction or malformations. In addition, 51 pregnant women had an inter-partum interval of less than two years (Figure 1).

Issues related to sexual health were also evident, with 17 pregnant women diagnosed with sexually transmitted infections (STIs). The occurrence of perinatal death was observed in five cases. Other obstetric histories included 14 pregnant women who had previously experienced preterm pregnancies and five pregnant women manifested hemorrhagic syndrome. Additional results included the use of illicit drugs by

three pregnant women. On the other hand, a group of 70 pregnant women had no obstetric history (Figure 1).

Figure 1. Obstetric history of pregnant women diagnosed with COVID-19. Teresina, Piauí, Brazil, 2023.

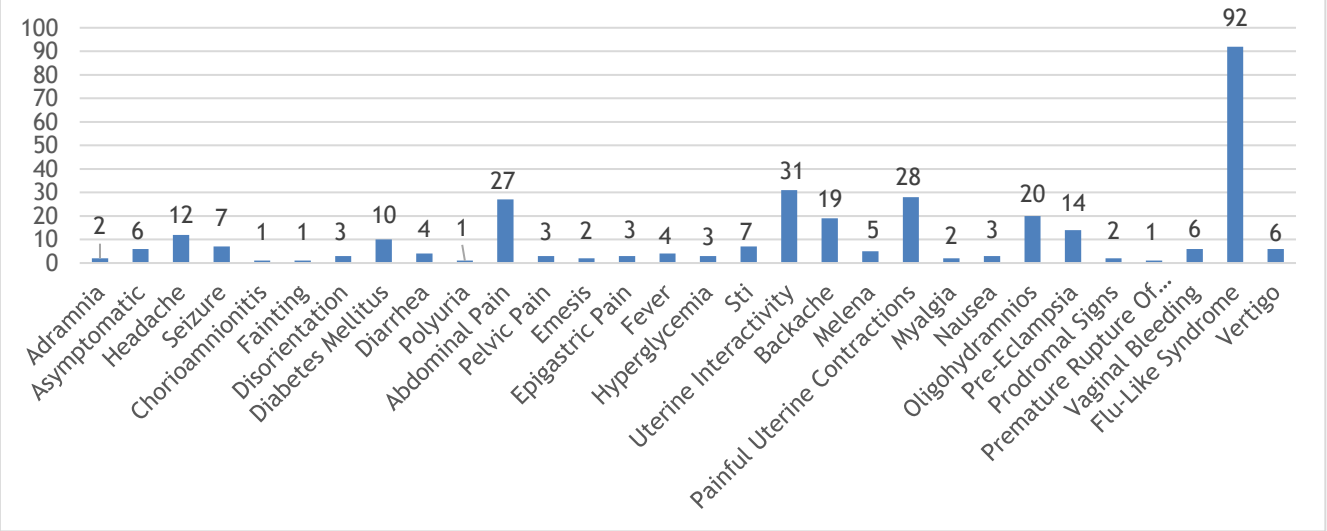


Source: authors, 2023.

Several pregnant women were registered with a variety of reasons for their hospitalization. Among the identified diagnoses, 92 cases of vaginal bleeding and 27 cases of abdominal pain stand out. The data analysis also revealed the presence of conditions like preeclampsia, with 14 hospitalized pregnant women (Figure 2).

As for the neurological conditions, 12 cases of headache and 7 cases of seizures were recorded. The occurrence of 31 cases of uterine iterativity and 28 cases of painful uterine contractions should also be stood out. In addition, it is important to mention that milder symptoms were also present, such as nausea (n=3) and dizziness (n=6). In terms of infections, seven cases of sexually transmitted infections were observed (Figure 2).

Figure 2. Reasons for the current hospitalization of pregnant women diagnosed with COVID-19. Teresina, Piauí, Brazil, 2023.



Source: authors, 2023.

Table 2 comprehensively displays the clinical manifestations of the new coronavirus. Of the 191 analyzed cases, a variety of symptoms were observed, providing a detailed view of the clinical picture of these pregnant women. Anosmia was observed in 8.90% of pregnant women and ageusia in 5.24%. Asymptomatic cases represented 37.70% of the sample, indicating a substantial percentage of pregnant women who did not manifest clinical symptoms. Headache (8.38%), runny nose (9.42%), and nasal congestion (5.24%) were also observed in some cases. In terms of respiratory symptoms, 12.57% of pregnant women manifested dyspnea, while cough was present in 15.18% of cases. Oxygen saturation ≤ 94% and tachypnea were less frequent, observed in 5.24% and 2.09% of pregnant women, respectively.

In addition, only one pregnant woman (0.52%) reported respiratory discomfort. As for other manifestations, diarrhea (3.14%), sore throat (4.19%), chest pain (3.66%), fever (7.33%), and myalgia (6.81%) were also observed in different percentages. These findings suggest that most pregnant women manifested a clinical picture of COVID-19 ranging from mild to moderate.

Table 2. Clinical manifestations of coronavirus in pregnant women diagnosed with COVID-19 (n= 191).

CLINICAL MANIFESTATIONS	YES		NO	
	n	(%)	n	(%)
Anosmia	17	8.90	174	91.10
Asymptomatic	72	37.70	119	62.30
Ageusia	10	5.24	181	94.76
Headache	16	8.38	175	91.62
Nasal congestion	10	5.24	181	94.76
Runny nose	18	9.42	173	90.58
Respiratory distress	1	0.52	190	99.48
Diarrhea	6	3.14	185	96.86
Dyspnea	24	12.57	167	87.43
Sore throat	8	4.19	183	95.81
Chest pain	7	3.66	184	96.34
Fever	14	7.33	177	92.67
Myalgia	13	6.81	178	93.19
O_2 saturation ≤ 94%	10	5.24	181	94.76
Tachypnea	4	2.09	187	97.91
Cough	29	15.18	162	84.82

Source: authors, 2023.

Table 3 displays the descriptive characteristics of newborns from mothers diagnosed with COVID-19. The results provided information on the birth profile, the health status of the newborns, and classification according to gestational age. Regarding the sex of the newborns, there was an almost balanced distribution, with 46.07% male and 53.93% female.

As for the Apgar evaluation, a crucial measure to evaluate the baby's vitality in the first moments after birth, most newborns had a score ranging from 7 to 10 (86.39%, n=165), indicating good vitality. Nonetheless, 6.28% (n=12) had a low score ranging from 0 to 3, indicating severe asphyxia, and 7.33% (n=14) received an intermediate score from 4 to 6, corresponding to moderate asphyxia.

The classification of newborns based on gestational age revealed a diverse distribution. Extreme preterm newborns represent 1.05% of the total. Very preterm newborns account for 4.71% of the sample. Late preterm newborns constituted a significant group, with 29.32% of cases. The term category includes most of the surveyed NBs, totaling 64.40%. Finally, only 0.52% of newborns were classified as post-term.

The analysis of the clinical outcomes of NBs revealed data that reflects the evolution of the health conditions of these patients. Of the 191 studied cases, most of them showed a positive evolution, resulting

in hospital discharge. A total of 178 NBs were discharged, indicating a satisfactory recovery and a transition to care outside the hospital environment. Nonetheless, in 13 cases, NBs were unable to overcome the health complications they faced, culminating in death.

Table 3. Descriptive characteristics of newborns of pregnant women diagnosed with COVID-19. Teresina, Piauí, Brazil, 2023.

BIRTH PROFILE	N	(%)
Sex		
Male	88	46.07
Female	103	53.93
Apgar		
0-3	12	6.28
4-6	14	7.33
7-10	165	86.39
Classification of newborns according to gestational age		
Extreme preterm (less than 30 weeks of GA)	2	1.05
Very preterm (30 to 33 weeks and 6 days)	9	4.71
Late preterm (34 to 36 weeks and 6 days)	56	29.32
Term (37 to 41 weeks and 6 days)	123	64.40
Post-term (more than 41 weeks)	1	0.52
Clinical outcome		
Death	13	6.81
Discharge	178	93.19

Source: authors, 2023.

There was a comprehensive overview of the health conditions observed in newborns of pregnant women who were diagnosed with COVID-19. Based on the collected data, it was possible to identify a variety of clinical manifestations that may be associated with this condition.

The analysis of the results revealed that most NBs are asymptomatic, totaling 86 cases. In contrast, some clinical manifestations stand out. It was observed that 22 NBs manifested neonatal jaundice. Respiratory manifestations were also present in this population of NBs. Apnea was reported in seven cases, while tachypnea and bradypnea were observed in five and nine cases, respectively. In addition to that, 11 NBs manifested cyanosis, one NB suffered perinatal anoxia, and eight manifested hypoxia.

In addition, other manifestations were documented, such as hypoglycemia, in 19 cases; hypoactivity in 17 cases; and hypotonia, in four cases. Among the observed results, prematurity was present in nine NBs. The issue related to weight was also relevant, as 14 NBs were born with low weight and two NBs had high birth weight.

Most newborns showed good vitality. This considerable percentage of healthy babies suggests that the medical team and care protocols are effectively ensuring a healthy start to life. A proportion showed a low score ranging from 0 to 3 on the Apgar index. These cases require immediate attention and urgent medical interventions to ensure survival and minimize damage. Additionally, another proportion of NBs received an intermediate score ranging from 4 to 6, indicating moderate asphyxia. Although not as serious as severe asphyxia, moderate asphyxia also requires a quick and effective medical response to prevent future complications. These cases can entail a clinical challenge, as they require careful evaluation to determine the severity of the condition and the appropriate treatment.

More severe conditions were also observed, such as heart failure, recorded in five NBs, as well as renal failure and respiratory failure, both in four NBs. Issues like cardiomegaly and microcephaly were recorded in one and two NBs, respectively. Isolated cases of nasal obstruction, thrombocytopenia, pneumonia, post-term birth, and sepsis were also identified. Specific syndromes were documented, including meconium aspiration syndrome, recorded in five NBs, and congenital syphilis, recorded in two NBs.

DISCUSSION

The COVID-19 pandemic impacted various areas of health and people's daily lives, as well as maternal-fetal health. The varied distribution in the number of pregnancies in this study is consistent with that of a previous study, which revealed a predominance of two pregnancies when considering the current pregnancy[19].

The diversity in the age range of pregnant women in this study reflects the global trend observed regarding COVID-19 infection. Epidemiological data suggest that pregnant women of different ages are susceptible to infection, although early studies have indicated an increased risk in older pregnant women[20]. Our research identified a higher frequency of cases of COVID-19 in women of reproductive age, that is, between 15 and 39 years, which is consistent with a previous study[21].

Although they are less frequent in this study, women over the age of 35 face an increased risk, given that they have a higher propensity for certain conditions, such as hypertension, diabetes, an increased incidence of cesarean sections, preterm labor, placenta previa, and premature rupture of membranes[22,23]. Additionally, pregnant and puerperal women are considered a group at greater vulnerability to COVID-19[24].

In this study, the higher occurrence of cesarean sections may be linked to the uncertainty regarding the probability of vertical transmission of the virus during natural birt[25]. Nonetheless, this preference for surgical delivery may also be influenced by various contextual factors, such as current clinical guidelines, the health conditions of the pregnant woman, and individual preferences. This predominance further emphasizes the importance of an individualized and careful evaluation to determine the most suitable mode of delivery in cases of pregnant women with COVID-19[26-28].

The presence of pregnant women with a history of previous abortions and uterine surgery highlights the importance of special attention to these groups of patients. Previous abortions may indicate risk factors for future complications and require closer monitoring. Uterine surgery can also influence the uterus's ability to sustain a pregnancy, thus requiring additional follow-up and care[29].

The identification of diabetes mellitus and hypertension highlights the relevance of controlling these conditions during pregnancy. Both diabetes and hypertension are linked to gestational complications, posing significant risks to maternal and fetal health[29]. In addition, it is important to emphasize that these conditions also increase susceptibility to a more severe case of COVID-19 infection[30]. Additionally, it is of utmost importance to recognize the relevance of other obstetric histories, even if they have not been meticulously cited, due to the limitations imposed by the availability of specific literature on these aspects.

This study revealed that a considerable percentage of asymptomatic pregnant women exist. This finding is notable as it highlights the importance of conducting comprehensive testing, even in seemingly healthy pregnant women, to identify asymptomatic cases and adopt preventive measures focused on preventing the spread of the virus and ensuring maternal care.

The clinical signs manifested by pregnant women affected by COVID-19 were similar to those observed in non-pregnant adults with the same infection, as reported in previous studies[4,25]. This suggests that the symptoms and clinical manifestation of the disease may not be substantially different between pregnant and non-pregnant individuals when infected with SARS-CoV-2. Nonetheless, it is important to consider that pregnancy itself can bring changes to women's immune and physiological systems, which may influence the manifestation of the disease.[31]

It is noticeable that COVID-19 infection may be associated with various complications during pregnancy. These complications include pre-eclampsia, impacts on fetal well-being, premature rupture of membranes, preterm births, and, in extreme cases, fetal death[32]. In a study with a cohort of women hospitalized due to the birth process, it was observed that the presence of COVID-19 was correlated with a significantly higher incidence of hospital mortality, preterm births, pre-eclampsia, premature placental abruption, and disseminated intravascular coagulation compared to women who did not have COVID-19[33].

The Apgar score considers five aspects: heart rate, respiratory effort, muscle tone, reflex irritability, and skin color, with each receiving a score from zero to two, totaling 10 points[34]. In addition to analyzing the health status of the NB outside the womb, it is also capable of measuring and establishing a link to the quality of care provided to the pregnant woman[35].

Regarding gestational age, more than half of NBs were born at term, which is a positive indication

of maternal health. Nonetheless, when one adds up all the cases of preterm newborns, they constitute a notable proportion. Nevertheless, it remains uncertain whether the increase in the number of preterm births is associated with COVID-19 complications in pregnant women or the possible impacts of the disease during pregnancy[36].

Studies that focused on evaluating maternal and perinatal outcomes pointed to an increased frequency of preterm births in newborns whose mothers were diagnosed with COVID-19. Nonetheless, despite this association, a low incidence of vertical transmission of the virus was observed and few clinical repercussions attributed to the disease in NBs[37,38].

In the context of the clinical outcome of NBs, the results of our research are aligned with those of other studies that also showed favorable clinical outcomes leading to hospital discharg[39]. The results of this research indicate that most of the analyzed newborns remained asymptomatic[40]. Nonetheless, it is important to recognize that the clinical picture is not uniform, as various clinical manifestations stand out, highlighting the need for an individualized approach in the evaluation and management of NBs.

The presence of a wide variety of symptoms is evident, which can be readily associated with other clinical conditions. Results obtained from case series conducted at the start of the pandemic highlight the possibility of viral and bacterial coinfections, which can not only complicate accurate diagnosis but also worsen the clinical picture of COVID-19[41]. Among the most recurrent signs and symptoms in newborns, neonatal jaundice, hypoglycemia, hypoactivity, cyanosis, bradypnea, prematurity, and hypoxia stood out.

Serious manifestations, such as heart failure, renal failure, and respiratory failure, emphasize the possibility of complications that require intensive and multidisciplinary therapeutic approaches[42]. In addition, the identification of specific syndromes, such as meconium aspiration syndrome and congenital syphilis, highlights the importance of investigating the underlying causes of clinical manifestations[43-44].

This study analyzed clinical manifestations in infected pregnant women, as well as symptoms and neonatal outcomes. This guides more effective clinical interventions and influences public health policies. It contributes to scientific knowledge, improvement of clinical practice, and public awareness about the risks of COVID-19 during pregnancy, aiming for better outcomes for mothers and newborns.

One limitation identified in the study concerns the lack of information in medical records regarding the results of COVID-19 tests performed on newborns. Additionally, there was no standardization in the process of registering NBs in the system. Due to the cross-sectional nature of the study, the lack of follow-up over time prevents the detection of evolutionary patterns in individual trajectories. Concerning the Apgar score, the information did not distinguish between measurements taken at the first and fifth minutes after birth.

Another point to be considered lies in the nature of this evaluation, which reflects the reality confined to a single health institution. Furthermore, it is crucial to recognize that the obtained outcomes may be subject to numerous interfering elements, ranging from the extent of the diagnostic evaluation to the procedures applied within the scope of medical care, not to mention the inherent particularities of the population under study.

CONCLUSION

In light of the discussions introduced in this study on clinical outcomes in neonates of pregnant women with COVID-19, it is evident that the complexity and interactions among the involved factors require a multifaceted and careful approach. The analysis of different variables highlights the need to consider each case individually. Our results show that COVID-19 infection during pregnancy may be associated with a variety of adverse neonatal outcomes.

Nonetheless, more research is needed to fully understand the underlying mechanisms of the observed outcomes and to develop more effective management and prevention strategies. Multidisciplinary collaboration among obstetricians, neonatologists, epidemiologists, and other health professionals is essential to ensure the best possible care for pregnant women and newborns during the COVID-19 pandemic.

As new variants of the virus emerge and pandemic control strategies evolve, it is essential to continue monitoring and evaluating clinical outcomes in newborns of pregnant women with COVID-19. This data will help us to guide evidence-based clinical practices and public health policies to ensure that future pregnancies and births occur as safely as possible in the face of the challenges posed by this pandemic.

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Study conception or design: Lima ACM, Batista OMA. Data collection: Lima ACM, Batista OMA. Contributed to the analysis and/or interpretation of data: Lima ACM, Moura MCS, Rocha ASC, Melo BMS, Rocha GST, Madeira MZA, Batista OMA. Article writing or critical review: Lima ACM, Moura MCS, Rocha ASC, Melo BMS, Rocha GST, Madeira MZA, Batista OMA. Final approval of the version to be published: Lima ACM, Moura MCS, Rocha ASC, Melo BMS, Rocha GST, Madeira MZA, Batista OMA.

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ETHICS APPROVAL

The study was approved by the Research Ethics Committee of the Federal University of Piauí (CEP/UFPI), according to opinion 5.254.342 and Certificate of Submission for Ethical Review 51036321.0.0000.5214.

CONFLICT OF INTEREST

The authors declare no conflict of interest.