

Investigating the Effect of COVID-19 during Pregnancy on Maternal and Neonatal Outcome

Shahrzad Zolala¹, Fereshteh Moradi¹, Leila Sharifi¹, Ali Hosseininasab², Zohreh Salari³, Zahra Shahriyari¹, Fatemeh Shojayee¹, Mansooreh Safizadeh⁴, Masumeh GHazanfar Pour¹, Katayoun Alidousti^{1*}

¹Department of Midwifery, School of Nursing and Midwifery Kerman University of Medical Sciences, Kerman, Iran; ²Department of Infectious and Tropical Research Center, Kerman University of Medical Sciences, Kerman, Iran; ³Department of Obstetrics and Gynecology, Afzalipour School of Medicine, Kerman University of Medical Sciences, Kerman, Iran; ⁴Department of Health, Kerman University of Medical Sciences, Kerman, Iran

ABSTRACT

Background: Physiological changes during pregnancy make the mother vulnerable to infections. Previous respiratory diseases have been found to cause maternal and neonatal complications. So present study was conducted to investigate the effects of COVID-19 on pregnancy, child birth, and the newborn.

Methods: This cross-sectional study was conducted on 653 pregnant women for 6 months in 2021 in Southeastern Iran (372 with COVID-19 during pregnancy and 281 without exposure). The questionnaire of demographic characteristics, maternal medical and midwifery records, and a checklist of observations and reports of pregnancy outcomes were completed for participants who consented to participate in the study.

Results: The mean age of the participants was 30.23 ± 6.35 years. The majority of them (91.88%) were homemakers. The mean gestational age of participants at the study time was 35.88 ± 4.34 weeks. COVID-positive mothers were (95% CI: 2.1 to 7.9) more likely to have a pre labor rupture of membranes than mothers without COVID. Additionally, meconium excretion was 11.62 times more likely in COVID-positive mothers. The infant was more likely to be admitted to the NICU, and the birth weight was lower than the control group.

Conclusions: Due to the maternal and neonatal complications caused by COVID-19, leading to an increased risk of maternal and infant mortality, screening of pregnant women, their vaccination, more accurate pregnancy care, and delivery in centers with more facilities are recommended.

Keywords: Pregnancy; COVID-19; Mortality; Neonate; Maternal; Respiratory syndrome

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and was declared a global pandemic in March 2020 [1]. The outbreak has caused fear and anxiety, especially among pregnant women. As little research has been conducted on the effects of this disease on the mother and fetus, there is concern about the complications caused by the disease. The resulting stress and anxiety weaken the immune system, and physiological changes in pregnant mothers' respiratory systems and immune systems make them more susceptible to infections [2]. Physiological

changes that occur during pregnancy make mothers vulnerable to severe infections. Anatomical changes, such as an increase in the diameter of the chest and an increase in the diaphragm level, reduce the mother's tolerance to hypoxia. Vasodilation and changes in lung volume can lead to mucositis and increased discharge in the upper respiratory tract. In addition, changes in the cell-mediated immune system increase the susceptibility of pregnant women to infection with intracellular organisms such as viruses [3]. There is currently no evidence for COVID-19 transmission from mother to fetus. Although the overall effect of MERS-CoV on mothers and birth outcome needs further evaluation, research has shown that MERS-CoV may pose

Correspondence to: Katayoun Alidousti, Department of Midwifery, Kerman University of Medical Sciences, Kerman, Iran; E-mail: alidoosti@kmu.ac.ir

Received: 21-Jan-2023, Manuscript No. MPN-23-21496; Editor assigned: 23-Jan-2023, PreQC No. MPN-23-21496 (PQ); **Reviewed:** 06-Feb-2023, QC No. MPN-23-21496; **Revised:** 25-Apr-2023, Manuscript No. MPN-23-21496 (R); **Published:** 29-Sep-2023, DOI: 10.35248/2472-1182.23.8.203

Citation: Zolala S, Moradi F, Sharifi L, Hosseininasab A, Salari Z, Alidousti K, et al. (2023) Investigating the Effect of Covid-19 During Pregnancy on Maternal and Neonatal Outcome. *Matern Pediatr Nutr.* 8:203.

Copyright: © 2023 Zolala S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

serious health risks to both the mother and the newborn [4]. This can cause sudden bleeding with pre labor rupture of membranes, mild to moderate changes in fetal heart rate pattern, and placental abruption leading to emergency cesarean section [5]. Studies conducted during the Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) outbreak in pregnancy have shown miscarriage, preterm birth, intrauterine growth restriction, intensive care unit admission, renal failure, and coagulation disorders [6,7]. Fetal complications of COVID-19 include miscarriage (2%), intrauterine growth restriction (10%), and preterm birth (39%) [8]. The study conducted by Ida Laake, et al., in 2018 indicated that mild flu during pregnancy was not associated with an increased risk of pre-eclampsia, post term birth or small for gestational age, but influenza infection during pregnancy may reduce birth weight [9]. Some recent observational studies have shown that people with asymptomatic and symptomatic COVID-19 and mild to severe infections may be at risk for adverse pregnancy outcomes. The present study was conducted to better understand the relationship between COVID-19 and delivery and neonatal outcomes.

LITERATURE REVIEW

Study design

The present study was a cross-sectional observational study aiming to determine the possible effects of COVID-19 during pregnancy on pregnancy, childbirth, and the newborn. This study was conducted for six months in 2021 in Southeastern Iran. The study population was all women pregnant during the COVID-19 pandemic. The participants were pregnant women with COVID-19 as the exposed group and pregnant women without COVID-19 as the control group.

Sample size

Since the study was cross-sectional, all individuals who met the inclusion criteria were included in the study after providing informed consent. The participants included 372 exposed and 281 non-exposed individuals.

Inclusion criteria for the exposed group: Positive PCR test result during pregnancy, not having received the COVID-19 vaccine during pregnancy, and providing consent to participate in the study.

Inclusion criteria for the non-exposed group: Not having received the COVID-19 vaccine during pregnancy and providing consent to participate in the study.

The research tool was a 3-part questionnaire. The first section of the questionnaire was dedicated to demographic characteristics, the second to maternal medical and midwifery records, and the third was a checklist of observations and reports of the pregnancy and childbirth outcomes. This researcher made checklist included questions about the clinical and midwifery status of the mother and fetus during labor and the status of the mother and newborn after labor. The checklist was designed based on previous studies and the opinions of midwives, gynecologists, and pediatricians. Content validity was used to

confirm the scientific validity of this checklist: The checklist was provided to 10 faculty members who reviewed the content, and their comments were finally applied.

Procedure

After receiving the code of ethics, the researchers talked to pregnant mothers referred to hospitals in Kerman, Southeastern Iran, for their childbirth. After explaining the research objectives and obtaining informed written consent, the mothers were included in the study. Demographic and midwifery information was collected through the interview. Other required information about the pregnancy, childbirth, and neonatal outcomes was collected by direct observation or the patient's file.

Data analysis

The collected information was analyzed using SPSS V21. In this study, descriptive statistical tests were used.

The mean age of participants was 30.23 years \pm 6.35 years. The majority were homemakers (91.88%), and 90.5% had high school education. The mean gestational age of participants at the time of the study was 35.88 weeks \pm 4.34 weeks. The mean gestational age at the time of COVID-19 infection was 32 weeks and one day. The mean time interval between infection and childbirth was 3 weeks. The two groups were homogeneous regarding their history of underlying diseases.

Maternal outcomes

Odds ratios showed COVID positive subjects to be more likely to have preterm rupture of membrane than those without COVID. Fetuses of COVID positive women were more likely to pass meconium than fetuses of those women who were not exposed. A positive odds ratio suggested an increased risk of high blood pressure in subjects with positive COVID (95% CI 1.41 to 14.8). Odds ratios showed COVID positive subjects to be more likely to have decreased fetal movement than those without COVID (1.06 to 6.64) $p=0.036$.

However, no statistically significant difference was observed between the exposure and control groups regarding the incidence of gestational diabetes, pre-eclampsia, placental abruption, post-term, oligohydramnios, Intra Uterine Fetal Death (IUFD), and postpartum complications such as atony and infection. The most common fetal heart rate patterns were nonreactive in the exposed group and variable deceleration in the control group. All (100%) of the COVID positive mothers were hospitalized and discharged after recovery.

Neonatal outcomes

The odds ratio of Neonatal Intensive Care Unit (NICU) admission among infants of COVID positive women versus COVID negative mothers was OR=2.35, 95% CI: 1.4 to 3.8.

The most common causes of neonate hospitalization were preterm birth and respiratory distress. Furthermore, the birth weight was 2485 grams \pm 863.25 grams in the exposed group and 2949 \pm 775.38 grams in the control group, which indicated

a significant difference. However, no significant difference was observed between the two groups regarding the first and fifth minute Apgar scores and the need for neonatal resuscitation.

Postpartum outcomes

The results showed that the rates of postpartum infection, embolism, atony and hysterectomy were not different in the two groups.

DISCUSSION

During pregnancy, women experience physiological changes that increase their susceptibility to respiratory infections and subsequent respiratory failure, a key concern in COVID-19 infections.

The present study's findings indicated that pregnant women with COVID-19 were more prone to hypertension than those in the control group, but the incidence of pre-eclampsia was not significantly different between the two groups. However, in a review article, Salmani reported that pregnant women exposed to COVID-19 were more likely to develop pre-eclampsia, preterm birth, gestational hypertension, anemia, hypothyroidism, and gestational diabetes [10]. In addition, Aris argued that COVID-19 was strongly associated with pre-eclampsia during pregnancy, especially among prim parous women [11].

COVID-19 directly or indirectly causes endothelial dysfunction, leading to severe inflammation and aberrant anti-viral responses. COVID-19 causes specific vascular pathology during pregnancy similar to the changes seen in pre-eclampsia. Mendoza et al., proposed the term "pre-eclampsia-like syndrome" induced by COVID-19 [12].

According to the study conducted by Juan, only a few of the neonates had low birth weight, and there was little need for NICU admission [13], whereas, in the present study, both were high. One of the mechanisms involved is pre-placental hypoxia, which can occur due to maternal respiratory disorders due to pneumonitis. This can be caused by a combination of pre-inflammatory factors leading to endothelial dysfunction and placental insufficiency. As a result, it contributes to relative fetal hypoxemia and, eventually, hypoxia [14]. The present study also showed higher odds of NICU admission due to preterm birth and respiratory distress. According to Zhu, 60% of the babies born to exposed mothers were born premature, and all needed respiratory support [15]. The association between COVID-19 and preterm birth may be due to increased maternal stress levels [16].

The results indicated that the newborns in the exposed group were more likely to develop meconium aspiration than those in the control group, which was in line with Nayak, who reported that 23.63%, 16.9%, and 10.5% of the newborns of mothers infected with COVID-19 had meconium aspiration syndrome, were premature, and had respiratory distress, respectively. MSAF is considered an indicator of fetal stress due to hypoxia and acidosis, triggering the vagus nerve response and increasing

peristalsis and the release of meconium into the uterine cavity. Risk factors for MSAF include placental insufficiency, maternal hypertension, pre-eclampsia, oligohydramnios, and umbilical cord compression [17].

In this study, 70.65% of women with COVID-19 gave birth by cesarean section, almost twice as many as the non-infected women. However, Francesca reported that mothers with COVID-19 are not at serious risk, and cesarean delivery should not be considered a method of ending their pregnancy [18]. Rasmussen also reported that fetal distress and preterm birth cases were rare and that the need for cesarean section was low [19]. However, according to the study conducted by Khalili, the occurrence of preterm birth and cesarean section was higher in mothers with COVID-19 infection [20].

CONCLUSION

The COVID-19 pandemic has directly or indirectly affected almost everyone worldwide with numerous consequences. Pregnant women and their fetuses may directly or indirectly experience the complications of this disease. According to the findings, mothers with COVID-19 exposure during their pregnancy are more at risk of high blood pressure, pre labor rupture of membranes, preterm birth, and meconium excretion during pregnancy. Moreover, their newborns are more at risk of respiratory distress and low birth weight and are more likely to be hospitalized in the NICU. Therefore, diagnosis and appropriate and timely treatment are essential for the mother and the newborn.

LIMITATIONS OF STUDY

The impossibility of mother and newborn follow-up for at least 6 weeks after childbirth to assess late maternal complications, the amount of breastfeeding, or stress in the mother and its impact on infant care can be considered a limitation of the present study. Another limitation was the lack of adequate facilities to investigate the vertical transmission of COVID-19 to the newborn.

ACKNOWLEDGEMENT

This research was supported by Kerman university of medical sciences. Thanks, and appreciation will come to all participants.

FINANCIAL DISCLOSURE STATEMENT

All authors declared that there are no existing or potential conflicts of interest of a financial, personal or any other nature that could affect or bias this research.

HUMAN RESEARCH STATEMENT

The study was approved by Kerman medical science ethics committee with the code IR.KMU.AH.REC.1399.054. The research objectives were explained to the participants, and they were included in the study after completing an informed written consent; participants were assured that their information would be confidential. At the request of the ethics committee, the

study was conducted in accordance with the declaration of Helsinki and ethics publication on Committee (COPE) special codes were used for each of the participants to ensure the information confidentiality.

REFERENCES

1. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. *The Lancet*. 2020;395(10223):470-473.
2. Wastnedge EA, Reynolds RM, Van Boeckel SR, Stock SJ, Denison FC, Maybin JA, et al. Pregnancy and COVID-19. *Physiol Rev*. 2021;101(1):303-318.
3. Goodnight WH, Soper DE. Pneumonia in pregnancy. *Crit Care Med*. 2005;33(10):S390-S397.
4. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV epidemic: Address mental health care to empower society. *Lancet*. 2020;395(10224):e37-e38.
5. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. *The Lancet*. 2020;395(10223):470-473.
6. Xiang Y-T, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*. 2020;7(3):228-289.
7. Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry*. 2020;7(4):e15-e16.
8. Dashraath P, Wong JL, Lim MX, Lim LM, Li S, Biswas A, et al. Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. *Am J Obstet Gynecol*. 2020;222(6):521-531.
9. Laake I, Tunheim G, Robertson AH, Hungnes O, Waalen K, Haberg SE, et al. Risk of pregnancy complications and adverse birth outcomes after maternal A (H₁N₁) pdm09 influenza: A Norwegian population-based cohort study. *BMC Infect Dis*. 2018;18:1-9.
10. Islam MM, Poly TN, Walther BA, Yang HC, Wang C-W, Hsieh W-S, et al. Clinical characteristics and neonatal outcomes of pregnant patients with COVID-19: A systematic review. *Front Med*. 2020;7:573468.
11. Papageorgiou AT, Deruelle P, Gunier RB, Rauch S, Garcia-May PK, Mhatre M, et al. Preeclampsia and COVID-19: Results from the inter-covid prospective longitudinal study. *Am J Obstet Gynecol*. 2021;225(3):289.
12. Mendoza M, Garcia-Ruiz I, Maiz N, Rodo C, Garcia-Manau P, Serrano B, et al. Pre-eclampsia-like syndrome induced by severe COVID-19: A prospective observational study. *BJOG*. 2020;127(11):1374-1380.
13. Juan J, Gil MM, Rong Z, Zhang Y, Yang H, Poon LC. Effect of coronavirus disease 2019 (COVID-19) on maternal, perinatal and neonatal outcome: Systematic review. *Ultrasound Obstet Gynecol*. 2020;56(1):15-27.
14. Thompson LP, Crimmins S, Telugu BP, Turan S. Intrauterine hypoxia: Clinical consequences and therapeutic perspectives. *Res Rep Neonatol*. 2015:79-89.
15. Zhu H, Wang L, Fang C, Peng S, Zhang L, Chang G, et al. Clinical analysis of 10 neonates born to mothers with 2019-nCoV pneumonia. *Transl Pediatr*. 2020;9(1):51.
16. Nayak MK, Panda SK, Panda SS, Rath S, Ghosh A, Mohakud NK. Neonatal outcomes of pregnant women with COVID-19 in a developing country setup. *Pediatr Neonatol*. 2021;62(5):499-505.
17. Rawat M, Nangia S, Chandrasekharan P, Lakshminrusimha S. Approach to infants born through meconium stained amniotic fluid: Evolution based on evidence?. *Am J Perinatol*. 2018;35(09):815-822.
18. Di Toro F, Gjoka M, Di Lorenzo G, de Santo D, de Seta F, Maso G, et al. Impact of COVID-19 on maternal and neonatal outcomes: A systematic review and meta-analysis. *Clin Microbiol Infect*. 2021;27:36e46.
19. Rasmussen SA, Smulian JC, Lednický JA, Wen TS, Jamieson DJ. Coronavirus Disease 2019 (COVID-19) and pregnancy: What obstetricians need to know. *Am J Obstet Gynecol*. 2020;222(5):415-426.
20. Khalil A, Kalafat E, Benlioglu C, O'Brien P, Morris E, Draycott T, et al. SARS-CoV-2 infection in pregnancy: A systematic review and meta-analysis of clinical features and pregnancy outcomes. *EClinicalMedicine*. 2020;25:100446.