



ORIGINAL ARTICLE

Maternal and fetal complications during COVID-19 pandemic- A study of Combined Military Hospital (CMH), Peshawar Pakistan.

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ABSTRACT... Objectives: To assess the association of maternal and neonatal complications from COVID-19 severity. **Study Design:** Case-series. **Setting:** Department of Obstetrics and Gynecology, Combined Military Hospital (CMH), Peshawar Pakistan. **Period:** June 2020 to Dec 2020. **Material & Methods:** 50 pregnant patients with COVID-19 were included. Clinical information on COVID-19 exposures and information on maternal and neonatal complications were noted through a pre-designed proforma. The Kendall's tau (τ) test was applied between maternal complications and neonatal complications, COVID-19 severity (in mothers) & maternal/neonatal complications. **Results:** More women (52%) were asymptomatic in COVID-19 exposure. Mild symptoms with no shortness of breath were reported in 44% of women, whereas only 4% required ventilator support. 80% of women were in postpartum when they turned COVID-19 negative. In the majority (72%) of women, no maternal complications were noted. In 14% of them, oligohydramnios was reported. Preterm labor and PROM/PPROM were reported in 6% of mothers. Preterm birth was reported 10%, fetal, the APGAR score was 7-9 out of 10. In the majority of neonates (94%), no early death was reported. 42% of distress/meconium was 8%, intrauterine growth restriction (IUGR) was 6%, and stillbirth was 5%. In 82% of neonates were COVID-19 negative on PCR. A strong correlation existed between maternal complications and neonatal complications. However, a weak correlation was observed between COVID-19 severity (in mothers) and maternal & neonatal complications. **Conclusion:** Although maternal and neonatal complications were strongly linked to each other, these complications had a weak association with the presence of COVID-19.

Key words: COVID-19, Maternal Complications, Neonatal Complications.

INTRODUCTION

During a coronavirus pandemic, there is an increasing demand for information on maternal and neonatal outcomes. In women with COVID-19, there is some evidence of vertical transmission of COVID-19 infection¹, but pregnancy-related problems and associated co-morbidities in women are little understood.² Pregnant women may be more susceptible to severe problems caused by the SARS-CoV-2, which might result in obstetrical difficulties.³ Studies were conducted to see the likelihood of vertical transmission.⁴ Mappa et al⁵ conducted a study to see how the COVID-19 epidemic affected pregnant women in Italy psychologically. The focus of the current study was to see how COVID-19 affected the mothers and neonates during pregnancy,

therefore we assessed the incidence of maternal and fetal complications in 50 pregnant women who were COVID-19 positive when admitted. The correlations were evaluated between maternal complications and neonatal complications, COVID -19 severity (in mothers) and maternal complications, and covid-19 severity (in mothers) and neonatal complications. Recent research has also suggested that VEGFs may have a role in the pathophysiology of COVID-19 infection.⁶ Pregnant women with COVID-19 had a higher risk of maternal mortality, intensive care unit hospitalization, and preterm delivery than those without the illness. Babies born to COVID-19-positive mothers had a higher probability of being admitted to the neonatal critical care unit than babies delivered to COVID-19-negative

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mothers. Severe COVID-19 during pregnancy is linked to pre-existing comorbidities, chronic hypertension, diabetes, maternal age, and BMI. COVID-19-positive pregnant women are more likely to give birth prematurely than those who do not, and they may have a greater risk of maternal death and admission to the intensive care unit.⁷

Several risk factors for COVID-19 infection sequelae in pregnant women have been identified, including pulmonary comorbidities, hypertensive disorders, and diabetes. The degree of maternal illness appears to impact obstetrical and neonatal outcomes.³ Gajbhiye et al¹ conducted a systematic analysis to look at the maternal and fetal outcomes in pregnant women who had COVID-19, as well as the rate of SARS-CoV-2 virus transfer from mother to child. They noticed that hypertension and diabetes were the frequent comorbidities in COVID-19-positive pregnant women, and therefore are a risk of premature birth and maternal mortality. In women with COVID-19, there is evidence of vertical transmission of SARS-CoV-2 infection. Soheili and Moradi² mentioned that the prevalence of neonatal death, low birth weight, stillbirth, preterm delivery, and intrauterine fetal distress in women with COVID-19. Furthermore, among pregnant women with COVID-19, the prevalence of fever, cough, diarrhea, and dyspnea was 56%, 29%, 9%, and 3%, respectively. Soheili and Moradi², also looked at the possibility of a higher risk of COVID-19 in pregnant women in the third trimester compared to the first and second trimesters.² Ashraf and Keshavarz⁴ assessed the clinical outcomes for both mothers and newborns from the exposure of COVID-19. The clinical features of pregnant women and non-pregnant COVID-19 patients did not differ significantly. Infection with COVID-19 has been linked to an increased risk of fetal distress and preterm labor in pregnant women. Although vertical transmission in pregnant women with COVID-19 infection is uncommon, four newborns' COVID-19 infection test findings were positive. Infection with COVID-19 has been linked to fetal discomfort and preterm labor in pregnant women. Even though vertical transmission in infected pregnant women is uncommon, four neonates tested positive for

COVID-19 infection.⁴

Mappa et al⁵ conducted a survey and received 89 % women respondents. COVID-19 was feared to cause prenatal morphological abnormalities in 47 % of the mothers, fetal growth restriction in 65 %, and preterm delivery in 51 %.⁵ Anxiety disorders affect 10% and 25% of pregnant women in industrialized and developing nations, respectively. Anxiety symptoms in pregnancy have been identified as a separate risk factor for poor obstetric and developmental outcomes. Anxiety during pregnancy may raise the risk of maternal mental health disorders, such as postpartum depression and delayed bonding, as well as obstetric difficulties, such as labor duration, preterm birth, and fetal development impairment. As a result, Mappa et al⁵ anticipated that the COVID-19 pandemic may have a significant influence on pregnant women's anxiety levels, which could change depending on their baseline anxiety level and pregnancy features.² Khan et al⁸ conducted a case-series study to see how SARS-CoV-2 infection affected pregnancy outcomes. The time between the start of infection and birth in this research was 1–26 days. The research included both healthcare employees and women from the general community. Five of the 17 newborns had neonatal pneumonia. COVID-19 was not found in the throat swabs of majority of newborns. In conclusion, Khan et al⁸ discovered two newborns with SARS-CoV-2 infection in neonates, indicating that COVID-19 infection may be related to poor pregnancy outcomes.⁸ Allotey et al⁷ reported that overall, COVID-19 was suspected or confirmed in 10% of pregnant and recently pregnant women who visited or were hospitalized to the hospital for any reason. Fever (40%) and cough (40%) were the most prevalent clinical symptoms of COVID-19 in pregnancy (41%).⁷

MATERIAL & METHODS

A case-series study was conducted for 6 months from June 2020 to Dec 2020 at the Department of Obstetrics and Gynecology in Combined Military Hospital (CMH), Peshawar Pakistan. Prior ethical approval from the institute before conducting the study (SR No.31).

A total of 50 pregnant patients were included who were positive for COVID-19 infection by PCR, were enrolled. COVID-19 PCR was done in the laboratory of (CMH), Peshawar. Informed consent was taken from all patients of their attendance for data collection.

Following clinical information was gathered through a pre-designed proforma from all patients: age at the presentation (years), parity (Primigravida, G2-4, G5 and more), maternal risk factors (HTN/ Pregnancy-induced hypertension-PIH, DM/ Gestational diabetes mellitus -GDM, H/O congenital abnormalities, epilepsy, thyroid disease, asthma/lung disease, or none), gestational age at COVID-19 positive (weeks), severity of COVID-19 (asymptomatic, mild symptoms & no shortness of breath-SOB, with SOB but maintaining saturation, required of oxygen support, and required ventilator support), COVID-19 contact history (yes/no), travel history during COVID-19 pandemic (yes/no), gestational age at COVID-19 negative (1st trimester, 2nd trimester, 3rd trimester or postpartum), gestational age at delivery (weeks), mode of delivery (spontaneous vaginal delivery-SVD, or lower segment caesarean section-LSCS), maternal complications (preterm labor, chorioamnionitis, miscarriage, premature rupture of membranes (PROM)/preterm premature rupture of membranes (PPROM), oligohydramnios, maternal death or none), neonatal complications (preterm birth, congenital abnormality, neonatal sepsis, fetal distress/meconium, intrauterine growth restriction-IUGR, intrauterine death-IUD/stillbirth, or none), APGAR (appearance, pulse, grimace, activity & respiration) score out of 10 (7-9, 5-6, <4, 0), early neonatal death (yes/no), birth weight (kg) and neonatal COVID-19 PCR (positive, negative, or not done).

Data Analysis

All data were entered and processed for frequencies and descriptive analysis in SPSS version 25. Mean \pm SD, minimum and maximum values were calculated for continuous variables. The Kendall's tau (τ) test was applied Ordinal variable vs. Ordinal variable from cross-tabulation in SPSS. The correlation coefficient

and p-value were calculated for each correlation. The correlations were determined to see if any significant difference exists between maternal vs. neonatal variables.

RESULTS

Table-I shows the detail of prevalence in each relevant parameter. Figure-1 shows the Maternal Risk Factors, Figure-2 shows the maternal complications, Figure-3 shows the COVID-19 severity in mothers, Figure-4 shows the gestational age at COVID-19 positive, Figure-5 shows the gestational age at COVID-19, and Figure-6 shows the gestational age at delivery. There were 31 (62%) females in the age range of 20-30 years and 15 (30%) were in 31-40 years. (Table-I). Most of the mothers (68%) were found in the parity of G2-4. (Table-I). Hypertension/pregnancy-induced hypertension was observed in 8% of women. Only 2% history related to congenital abnormalities was reported. The majority (90%) did not report any risk factor. (Table-I). The mean gestational age on positive COVID-19 was 36.16 ± 3.787 weeks. The maximum number (18-22%) of women were in 38-39 weeks of gestational age when they become positive for COVID-19 (see Table-I for details). More women (52%) were asymptomatic in COVID-19 exposure. Mild symptoms and no shortness of breath were reported in 44% of women, whereas only 4% required ventilator support. (see Table-I for details). 46% of mothers reported COVID-19 by contact. The majority (88%) of mothers had no travel history. (Table-I).

This is the Gestational age when the patient became COVID-19 negative. 2% of women were in their second trimester when they became COVID-19 negative, and 18% were in their third trimester. 80% of women were in postpartum when they became COVID-19 negative. (see Table-I for details). The mean gestational age at delivery was 37.52 ± 2.636 weeks. The maximum number (34%) of women were in 38 weeks of gestational age at delivery. (Table-I). In 54% of women had a spontaneous vaginal delivery (SVD), and 46% of women, had to undergo a lower segment cesarean section-LSCS. (Table-I). In the majority (72%) of women, no maternal complications were noted. In 14% of them, oligohydramnios was

reported. Preterm labor was reported in 6% and PROM/PPROM was reported in 6% of mothers. (Table-I for details).

Table-II shows the detail of prevalence in each relevant parameter. Figure-7 shows the APGAR Score, Figure-8 shows the birth weight of neonatal (kg), Figure-9 shows the neonatal complications and Figure-10 shows the early neonatal death. Preterm birth was reported 10%, fetal distress/meconium was 8%, Intrauterine growth restriction (IUGR) was 6%, and Intrauterine death-(IUD)/stillbirth was 5%. Whereas, 72% had no neonatal complications. (Table-II). In 82% of neonates, the APGAR score was 7-9 out of 10. APGAR score 5-6 was reported in 8%, less than 4 in 6%, and 0 in 4% of neonates. (Table-II). In the majority of neonates (94%), no early death was reported. (Table-II). The mean birth weight was 3.082 ± 0.566 kg. Birth weights 3.40 kg and 3.50 kg were reported in 14% of neonates. Birth weights 3.30 kg and 3.00 kg were reported in 12% of neonates. (Table-II for details). 42% of neonates were COVID-19 negative on PCR. In 56% of them, the PCR test was not done (Table-II for details).

Kendall's tau (b) correlations were applied through cross-tabulations between maternal complications & neonatal complications, COVID-19 severity (in mothers) & maternal complications, and covid-19 severity (in mothers) & neonatal complications (See Table-III). All these correlations were significant with the following p values: 0.000, 0.017, and 0.001. However, only one correlation that is, tabulations between maternal complications & neonatal complications was discovered as a strong correlation. The rest of the correlations were weak in strength statistically.

Key Table-I: HTN/PIH: hypertension/Pregnancy induced HTN; SVD: Spontaneous vaginal delivery; LSCS: Lower segment caesarean section; PROM: Premature rupture of membranes; PPRM: Preterm premature rupture of membranes.

Variables/ Parameters	Sub-parameters	Frequency n(%)
Mother age (years) (at the time of presentation)	< 20	4(8%)
	20-30	31(62%)
	31-40	15(30%)
Parity	Primigravida	5(10%)
	G2-4	34(68%)
	G5 and more	11(22%)
Maternal Risk Factors	HTN/PIH	4(8%)
	History of congenital abnormalities	1(2%)
Gestational age at COVID-19 (+ve) in weeks (on PCR) Mean: 36.16 ± 3.787 weeks Minimum: 25 weeks Maximum: 40 weeks	None	45(90%)
	38	11(22%)
	39	9(18%)
	40	7(14%)
	32	5(10%)
	35	4(8%)
COVID-19 Severity	37	4(8%)
	Asymptomatic	26(52%)
	Mild symptoms & no shortness of breath-SOB	22(44%)
	Required ventilator support	2(4%)
Contact History	Yes	23(46%)
	No	27(54%)
Travel History	Yes	6(12%)
	No	44(88%)
Gestational age at COVID-19 (-ve)	2 nd Trimester	1(2%)
	3 rd Trimester	9(18%)
	Postpartum	40(80%)
Gestational age at delivery Mean: 37.52 ± 2.636 weeks Minimum: 26 weeks Maximum: 40 weeks	38 weeks	17(34%)
	39 weeks	11(22%)
	40 weeks	7(14%)
	37 weeks	5(10%)
	35 weeks	4(8%)
Mode of delivery	SVD	27(54%)
	LSCS	23(46%)
Maternal Complications	preterm labor	3(6%)
	PROM/ PPRM	3(6%)
	oligohydramnios	7(14%)
	None	36(72%)
	maternal death	1(2%)

Table-I. Prevalence of maternal complications from the exposure of COVID-19 (n=50)

Variables/ Parameters	Sub-parameters	Frequency n(%)
Neonatal Complications	Preterm birth	5(10%)
	Fetal Distress/ meconium	4(8%)
	Intrauterine growth restriction-IUGR	3(6%)
	Intrauterine death- IUD/stillbirth	2(4%)
	None	36(72%)
APGAR Score (out of 10)	7-9	41(82%)
	5-6	4(8%)
	<4	3(6%)
	0	2(4%)
Early Neonatal Death	Yes	3(6%)
	No	47(94%)
Birthweight (kg) Mean: 3.082±0.566 kg Minimum: 1 kg Maximum: 3.60 kg	3.50	7(14%)
	3.40	7(14%)
	3.30	6(12%)
	3.00	6(12%)
	3.20	5(10%)
	3.60	5(10%)
	3.10	3(6%)
Neonatal COVID-19 Positive	Positive	1(2%)
	Negative	21(42%)
	Not done	28(56%)

Table-II. Prevalence of neonatal complications from the exposure of COVID-19 (n=50)

Correlation	Correlation Coefficient	P- Value	Correlation Strength
Maternal Complications vs. Neonatal Complications	0.663	0.000 Significant	Strong
COVID-19 Severity (in mothers) vs. Maternal Complications	0.341	0.017 Significant	Weak
COVID-19 Severity (in mothers) vs. Neonatal Complications	0.397	0.001 Significant	Weak

Table-III. Kendall's Tau (b) (τ) Correlations

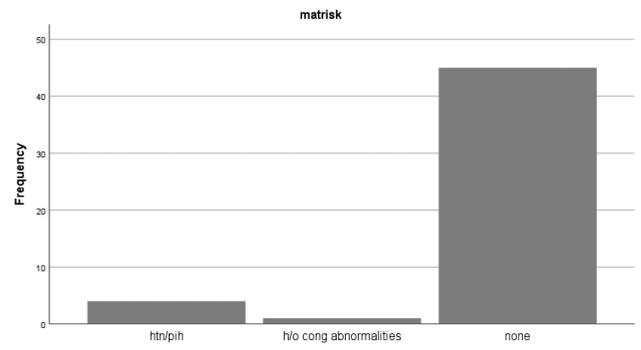


Figure-1. Maternal risk factors

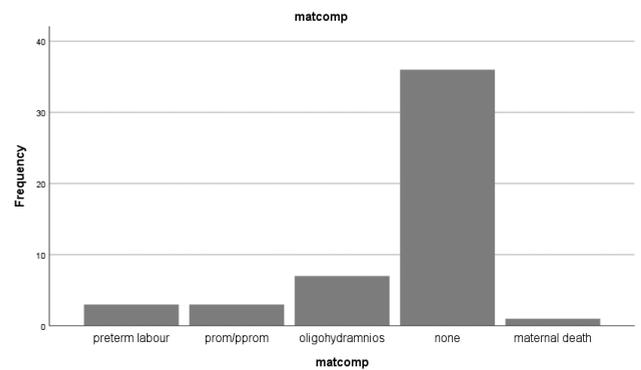


Figure-2. Maternal complications

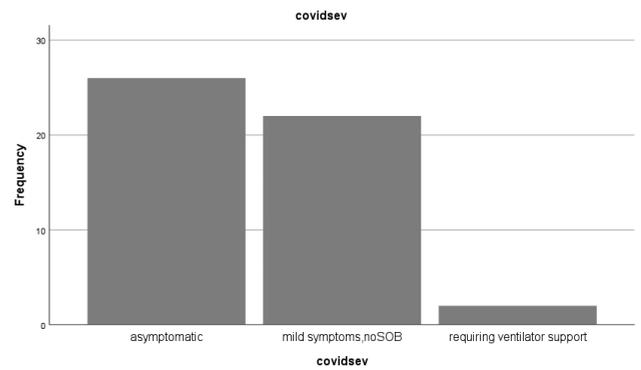


Figure-3. COVID-19 severity in mothers

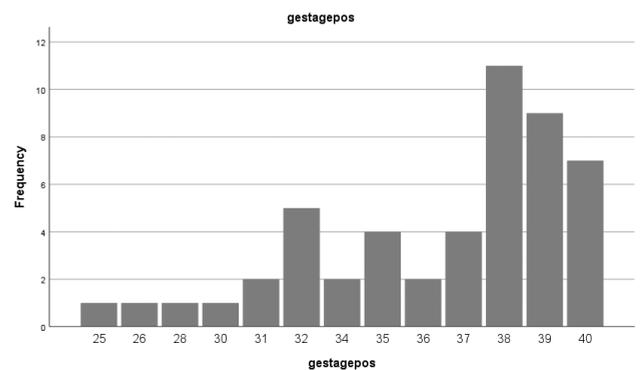


Figure-4. Gestational age at COVID-19 positive

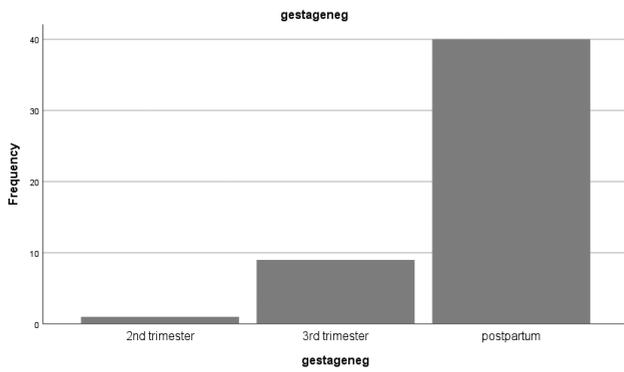


Figure-5. Gestational age at COVID-19 (weeks)

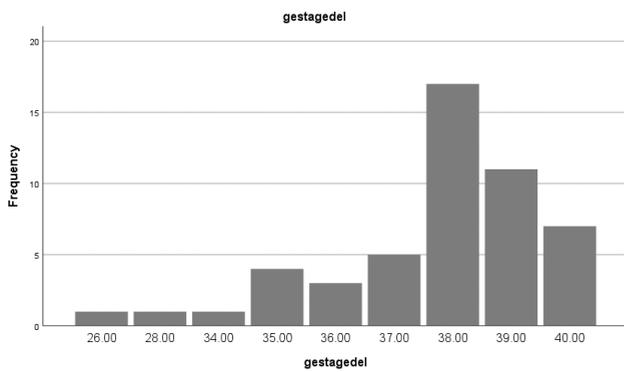


Figure-6. Gestational age at delivery

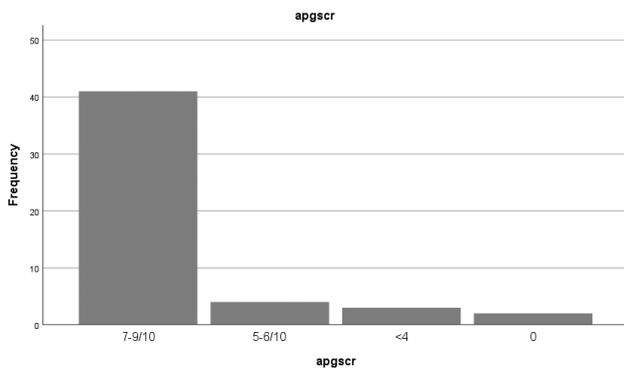


Figure-7. APGAR Score

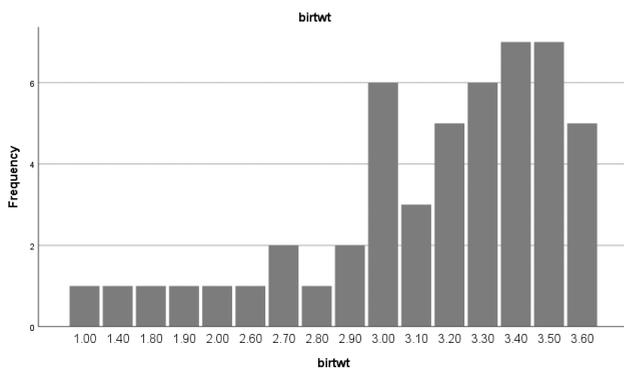


Figure-8. Birth weight of neonatal (kg)

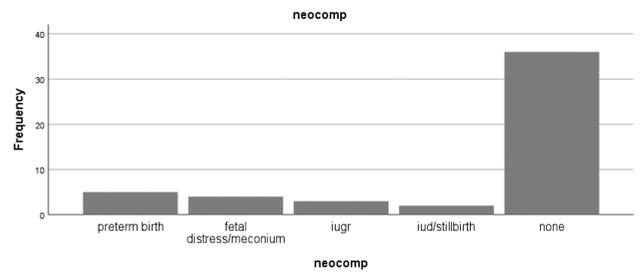


Figure-9. Neonatal complications

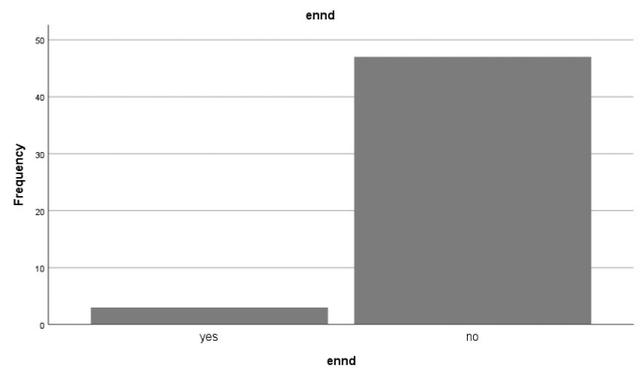


Figure-10. Early neonatal death

DISCUSSION

The coronavirus disease epidemic of 2019 is spreading fast throughout the world. However, little is known regarding the link between COVID-19 infection in pregnant women and the chance of having fetal complications.⁹ In COVID-19 exposure, more women (52%) were asymptomatic in the current study. Only 4% of women required ventilator assistance, while 44% had mild symptoms and no shortness of breath. When 80% of women tested negative for COVID-19, they were in the postpartum period. There were no maternal problems in the majority of women (72%).

In our patients, the oligohydramnios was found in 14% of the cases. Preterm labor was recorded in 6% of women, as was PROM/PPROM in 6% of mothers. Preterm delivery was recorded in 10% of the cases, fetal distress/meconium in 8% of the cases, intrauterine growth restriction (IUGR) in 6% of the cases, and intrauterine death (IUD) in 5% of the cases. In contrast, 72% of the babies had no neonatal problems. The APGAR score was 7-9 out of 10 in 82% of newborns. No early death was observed in the current study in the majority

of newborns (94%). On PCR, 42% of newborns tested negative for COVID-19. We found that the maternal complications and newborn issues had a strong association (p-value: 0.000). Surprisingly, in a mother who was on the ventilator and died, her baby had no complications, whereas, in patients with fever only, intrauterine death occurred. The mean gestational age on positive COVID-19 was 36.16 weeks in our study. The maximum number (18-22%) of women were in 38-39 weeks of gestational age when they become positive for COVID-19. Yan and Juanjuan reported that the average gestational age on admission was 38 weeks in COVID-19 exposed females.¹⁰ Yang et al reported that the coronavirus illness was diagnosed in 65 pregnant women out of 11,078. There were no fatalities among the confirmed patients or their babies.

The difference in low birth weight, neonatal hypoxia, and PROM between women with and without COVID-19 was not statistically significant.⁹ They reported that none of the babies delivered to COVID-19-positive women tested positive for the COVID-19. Only one of the patients experienced diarrhea, and three of them developed a fever.⁹ Yang et al⁹ reported that COVID-19 exposure later in pregnancy is linked to a higher risk of poor birth outcomes, such as iatrogenic preterm birth and cesarean delivery. Vouga et al³ studied the severity of the condition, as well as the obstetrical and immediate neonatal outcomes. Cesarean section (70.7%), premature birth (62.7%), and babies needing admission to the neonatal intensive care unit (41.3%) were all more likely in pregnant women with poor maternal outcomes.³

Torri et al¹¹ found that the severe-critical COVID-19 was linked to a higher risk of cesarean delivery, hypertensive disorders of pregnancy, and preterm birth as compared to asymptomatic individuals. When compared to asymptomatic individuals, mild-moderate COVID-19 was not linked to poor prenatal outcomes. These findings imply that pregnant women with higher COVID-19 severity levels are more likely to experience perinatal problems. Clinicians should be aware of these risks and, if possible, pursue measures to reduce consequences.¹¹ Coronavirus infection

has been associated with poor maternal and infant outcomes in pregnancy, but there is little controlled research that quantifies these risks or explains their epidemiology and risk factors.

Brandt et al¹² described the epidemiology and risk factors associated with COVID-19 and poor maternal and newborn outcomes in pregnancy. Cases had a 3.4 times greater chance of having a worse composite maternal outcome than controls. Antoun et al¹³ investigated the influence of COVID-19 on neonatal outcomes from singleton and multiple pregnancies. The severity of the symptoms varied from mild (65.2%), moderate (8.7%), and severe (8.7%) of pregnant patients. Pre-existing co-morbidities were present in 48% of the patients, with morbid obesity in 21.7% and diabetes in 17.4% being the most frequent. Eighteen of the twenty new babies were singletons with a set of twins. When compared to non-COVID pregnancies, COVID-19 is linked to a higher rate of preterm delivery, preeclampsia, and cesarean section. The babies were not infected with COVID-19, and none of them suffered serious neonatal problems.¹³ According to new evidence, pregnant women who are infected with COVID-19 have a more severe illness than their non-pregnant counterparts. Placental damage has been seen in women infected with COVID-19 during pregnancy, although the clinical relevance of this is uncertain.¹⁴

Patberg et al¹⁵ conducted a retrospective cohort analysis and reported oligohydramnios in 7.8% of COVID-19 exposed pregnant women. It has been mentioned that during pregnancy, infection with the COVID-19 is not linked to a higher risk of spontaneous abortion or premature delivery. When the illness shows during the third trimester of pregnancy, there is no indication of vertical transmission of COVID-19 infections.^{10,16} Khalil et al¹⁷ looked at the rates of stillbirths and premature births. Women infected with the SARS-CoV-2 had a high incidence of preterm birth and cesarean delivery. However, studies with insufficient power to assess rare events such as stillbirth (fetal death before 24 weeks of pregnancy) have been conducted. In women with confirmed COVID-19, the UK Obstetric Surveillance System recorded

three stillbirths out of 247 completed pregnancies, compared to the national rate of one. There were no signs or symptoms of COVID-19 infection in any of the pregnant women who had stillbirths, and neither the postmortem nor placental tests revealed SARS-CoV-2 infection.¹⁷ The findings encourage the design of research to see if behavioral or social changes in pregnant women might enhance pregnancy outcomes.¹⁸ Multidisciplinary treatment and ongoing research will be required as we treat more individuals with SARS-CoV-2 to ensure the best possible outcomes for mother and fetus.¹⁹

CONCLUSION

There is limited evidence of vertical transmission of COVID-19 due to scarce data. Pregnant women are a special group of persons impacted by the current COVID-19 pandemic. Although preliminary research suggests that the illness course and severity are comparable in pregnant and non-pregnant individuals, further research is needed. Although patients will have moderate sickness, significant maternal morbidity, and death as has been reported in individuals with a severe and critical illness. The great bulk of existing evidence is based on hospitalized, symptomatic third-trimester individuals. The majority of the available research is centered on hospitalized, symptomatic third-trimester women. If symptoms appear, neonates should be admitted to a neonatal facility with the provision of supportive therapies. For a better understanding of the disease's progression during pregnancy, more studies are required.

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REFERENCES

- Gajbhiye RK, Modi DN, Mahale SD. **Pregnancy outcomes, newborn complications and maternal-fetal transmission of SARS-CoV-2 in women with COVID-19: A systematic review of 441 cases.** MedRxiv. 2020 Jan 1.
- Soheili M, Moradi G, Baradaran HR, Soheili M, Mokhtari MM, Moradi Y. **Clinical manifestation and maternal complications and neonatal outcomes in pregnant women with COVID-19: A comprehensive evidence synthesis and meta-analysis.** The Journal of Maternal-Fetal & Neonatal Medicine. 2021; 15:1-4.
- Vouga M, Favre G, Martinez-Perez O, Pomar L, Acebal LF, Abascal-Saiz A, Hernandez MR, Hcini N, Lambert V, Carles G, Sichitiu J. **Maternal outcomes and risk factors for COVID-19 severity among pregnant women.** Scientific reports. 2021; 11(1):1-1.
- Ashraf MA, Keshavarz P, Hosseinpour P, Erfani A, Roshanshad A, Pourdast A, Nowrouzi-Sohrabi P, Chaichian S, Poordast T. **Coronavirus disease 2019 (COVID-19): A systematic review of pregnancy and the possibility of vertical transmission.** Journal of reproduction & infertility. 2020; 21(3):157.
- Mappa I, Distefano FA, Rizzo G. **Effects of coronavirus 19 pandemic on maternal anxiety during pregnancy: A prospective observational study.** Journal of Perinatal Medicine. 2020; 48(6):545-50.
- Yazihan N, Tanacan A, Erol SA, Anuk AT, Sinaci S, Biriken D, Keskin HL, Moraloglu OT, Sahin D. **Comparison of VEGF values between pregnant women with COVID-19 and healthy pregnancies and its association with composite adverse outcomes.** Journal of Medical Virology. 2021; 93(4):2204-9.
- Allotey J, Stallings E, Bonet M, Yap M, Chatterjee S, Kew T, Debenham L, Llavall AC, Dixit A, Zhou D, Balaji R. **Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: Living systematic review and meta-analysis.** Bmj. 2020; 370.
- Khan S, Jun L, Siddique R, Li Y, Han G, Xue M, Nabi G, Liu J. **Association of COVID-19 with pregnancy outcomes in health-care workers and general women.** Clinical microbiology and infection. 2020; 26(6):788-90.
- Yang R, Mei H, Zheng T, Fu Q, Zhang Y, Buka S, Yao X, Tang Z, Zhang X, Qiu L, Zhang Y. **Pregnant women with COVID-19 and risk of adverse birth outcomes and maternal-fetal vertical transmission: A population-based cohort study in Wuhan, China.** BMC medicine. 2020; 18(1):1-7.
- Yan J, Guo J, Fan C, Juan J, Yu X, Li J, Feng L, Li C, Chen H, Qiao Y, Lei D. **Coronavirus disease 2019 in pregnant women: a report based on 116 cases.** American journal of obstetrics and gynecology. 2020 1; 223(1):111-e1.
- Metz TD, Clifton RG, Hughes BL, Sandoval G, Saade GR, Grobman WA, Manuck TA, Miodovnik M, Sowles A, Clark K, Gyamfi-Bannerman C. **Disease severity and perinatal outcomes of pregnant patients with coronavirus disease 2019 (COVID-19).** Obstetrics and gynecology. 2021; 137(4):571.

12. Brandt JS, Hill J, Reddy A, Schuster M, Patrick HS, Rosen T, Sauer MV, Boyle C, Ananth CV. **Epidemiology of coronavirus disease 2019 in pregnancy: Risk factors and associations with adverse maternal and neonatal outcomes.** American journal of obstetrics and gynecology. 2021; 224(4):389-e1.
13. Antoun L, El Taweel N, Ahmed I, Patni S, Honest H. **Maternal COVID-19 infection, clinical characteristics, pregnancy, and neonatal outcome: A prospective cohort study.** European Journal of Obstetrics & Gynecology and Reproductive Biology. 2020; 252:559-62.
14. Kucirka LM, Norton A, Sheffield JS. **Severity of COVID-19 in pregnancy: A review of current evidence.** American Journal of Reproductive Immunology. 2020; 84(5):e13332.
15. Patberg ET, Adams T, Rekawek P, Vahanian SA, Akerman M, Hernandez A, Rapkiewicz AV, Ragolia L, Sicuranza G, Chavez MR, Vintzileos AM. **Coronavirus disease 2019 infection and placental histopathology in women delivering at term.** American journal of obstetrics and gynecology. 2021; 224(4):382-e1.
16. Li N, Han L, Peng M, Lv Y, Ouyang Y, Liu K, Yue L, Li Q, Sun G, Chen L, Yang L. **Maternal and neonatal outcomes of pregnant women with coronavirus disease 2019 (COVID-19) pneumonia: A case-control study.** Clinical infectious diseases. 2020; 71(16):2035-41.
17. Khalil A, Von Dadelszen P, Draycott T, Ugwumadu A, O'Brien P, Magee L. **Change in the incidence of stillbirth and preterm delivery during the COVID-19 pandemic.** Jama. 2020; 324(7):705-6.
18. Hedley PL, Hedermann G, Hagen CM, Bækvad-Hansen M, Hjalgrim H, Rostgaard K, Laksafoss AD, Hoffmann S, Jensen JS, Breindahl M, Melbye M. **Preterm birth, stillbirth, and early neonatal mortality during the Danish COVID-19 lockdown.** medRxiv. 2021 Jan 1.
19. Thompson JL, Nguyen LM, Noble KN, Aronoff DM. **COVID-19-related disease severity in pregnancy.** American Journal of Reproductive Immunology. 2020; 84(5):e13339.

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