

Pregnancy-Induced Hypertension and Gestational Diabetes Impact on Fetomaternal Outcomes in COVID-19-Positive Women Hospitalized for Delivery

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ABSTRACT

Background: Studies evaluating the impact of pregnancy-related disorders among COVID-19-positive women on fetomaternal outcomes remained scarce. Therefore, we assessed the impact of pregnancy-induced hypertension (PIH) and gestational diabetes mellitus (GDM) on fetomaternal outcomes in COVID-19-positive women hospitalized for delivery.

Patients and methods: A review of medical records of 37 COVID-19-positive pregnant women hospitalized at Sir Ganga Ram Hospital Lahore from April to June 2020 was performed. Data retrieved included demographics, comorbid illnesses, and maternal and fetal outcomes. Using SPSS v.26, a Chi-square test was done to assess the impact of comorbid illnesses on fetomaternal outcomes.

Results: The mean age of the cases was 25.8 ± 4.6 years, the gestational age was 37.5 ± 1.2 weeks, and the frequency of primigravida was 24.3%. PIH ($n = 08$, 21.6%) was the most frequent comorbid illness followed by GDM ($n = 05$, 13.5%). Women with comorbid illness showed statistically significant differences for cesarean delivery (64.3% *vs.* 35.7%, p -value = 0.022), duration of hospital stay (8.2 ± 3.8 *vs.* 5.6 ± 1.6 days, p -value = 0.009), low birth weight (85.7% *vs.* 14.3%, p -value = 0.007), NNU admission (60.0% *vs.* 40.0%, p -value = 0.009), and marked differences for both maternal and neonatal mortality (100% *vs.* 0.0%, p -value = 0.078) as compared to women without any comorbid illness, respectively.

Conclusions: Comorbidities including PIH and GDM among COVID-19-positive women hospitalized for delivery, had a higher incidence of adverse fetomaternal outcomes and longer hospital stay. These findings suggest that women with comorbid illness require personalized treatment to prevent or decrease poor pregnancy outcomes.

Keywords:

COVID-19, Comorbidities, Gestational diabetes, Pregnancy induced hypertension, Fetomaternal outcome

INTRODUCTION

Coronavirus disease 2019 (COVID-19) by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) impacted the healthcare systems across the world.¹ Women during pregnancy experience physiological and immunological changes, which make them more susceptible to viral infections, including COVID-19. Available literature suggests that pregnant women have a higher risk of serious illness and death during pandemics like influenza, Ebola, or SARS-CoV-2, and a mortality rate of up to 37% has been reported in pregnant women compared with 2.6% in the general population.^{2,3} Comorbid illnesses such as pregnancy

induced hypertension (PIH), and gestational diabetes mellitus (GDM), particularly if poorly controlled, is identified as a risk factor for more serious effects of COVID-19 with subsequently high mortality.⁴ The main etiopathogenesis demonstrates an upsurge in inflammation, a decline in immuno-competence and an imbalance of clotting factors, increasing the risk of thrombosis. Due to this threefold additive effect, patients in this particular cohort require close supervision if COVID-19 infection arises. These patients are more at risk of stillbirth, respiratory distress, cardiovascular dysfunction, diabetic ketoacidosis and death.^{5,6} Several studies assessed the impact of COVID-19 during pregnancy on maternal, fetal and neonatal outcomes. However, data about the impact of COVID-19 combined with other comorbid illnesses on fetomaternal outcomes has been scarce. This study aims to evaluate the impact of comorbid PIH and GDM on fetomaternal outcomes in COVID-19-positive women hospitalized for delivery.

Conflict of interest: The authors declared no conflict of interest exists.

Citation: Nasir-Ud-Din A, Akram H, Latif F, Munir SI. Pregnancy-induced hypertension and gestational diabetes impact on fetomaternal outcomes in COVID-19-positive women hospitalized for delivery. J Fatima Jinnah Med Univ. 2024; 18(1):20-24.

DOI: <http://doi.org/10.37018/JFJMU/9854>

PATIENTS AND METHODS

The retrospective study was done at the Department of Obstetrics and Gynaecology Unit-III, Sir Ganga Ram Hospital Lahore from April to June 2020 after approval by the Institutional Ethics Review Board. A total of 37 COVID-19-positive women hospitalized for delivery were identified from hospital records. Inclusion criteria were pregnant women admitted with a diagnosis of COVID-19, gestational age 20-40 weeks, with and without comorbid illness (PIH, GDM or both). Exclusion criteria were pregnant women with known hypertension, diabetes, asthma, tuberculosis or multiple pregnancies. Pregnant women who had a positive nasopharyngeal/oropharyngeal swab for viral RNA using rRT-PCR were defined as COVID-19 positive. Blood pressure $\geq 140/90$ mmHg during pregnancy with previous history of normal BP defined as PIH. While 75g two hours OGTT and IADPSG criteria were used for the diagnosis of GDM. Death during hospitalization from the date of admission till the date of discharge is defined as mortality. Birth weight < 2500 grams is defined as low birth weight. A close-ended structured proforma was specially designed for the study used for data collection. Baseline secondary data retrieved from patients' admission including age, gestational age, comorbid illness, Hb, platelet count, ALT, uric acid, plasma glucose, and proteinuria were noted. Maternal parameters included mode of delivery, ICU admission requirement, supplemental O₂ requirement, non-invasive and invasive mechanical ventilation requirement, maternal mortality, and duration of hospitalization. Fetal outcome parameters included APGAR score, amniotic fluid volume, placental localization, birth weight, neonatal unit (NNU) admission requirement, and neonatal mortality. Statistical Package for Social Sciences (SPSS) version 26 was used for data entry and analysis. Mean and standard deviation were computed for age, gestational age, lab parameters, hospitalization duration and birth weight. Frequency and percentage computed for comorbid illness, fetal and maternal outcomes. The chi-square test was used to assess the impact of comorbid illness on fetomaternal outcomes. A p-value ≤ 0.05 is considered as significant.

RESULTS

A total of 37 pregnant women with COVID-19 were identified from hospital records. Among them, 9 (24.3%) were primigravida. Their mean age was 25.8 ± 4.6 years (range 18 to 35 years). Mean gestational age was 37.5 ± 1.2 weeks (range from 35 to 39 weeks).

Table 1: Characteristics of the study population (N=37)

Characteristics	N (%)	Mean \pm SD
Gravida		
Multigravida	28 (75.7%)	
Primigravida	09 (24.3%)	
Age (years)		
≤ 25	18 (48.6%)	25.8 ± 4.6
> 26	19 (51.4%)	
Gestational age (weeks)		
< 37	07 (18.9%)	37.5 ± 1.2
≥ 37	30 (81.1%)	
Hb level (g/dl)		
< 11.5	34 (91.9%)	9.0 ± 1.6
≥ 11.5	03 (8.1%)	
Platelet count ($10^9/L$)		
< 140	14 (37.8%)	158 ± 54
≥ 140	23 (62.2%)	
ALT level (IU/L)		
≤ 40	16 (43.2%)	49 ± 17
> 40	21 (56.8%)	
Uric acid level (mg/dl)		
≤ 6.2	30 (81.1%)	5.8 ± 1.4
> 6.2	07 (18.9%)	
Proteinuria		
No	26 (70.3%)	-
Yes	11 (29.7%)	
Plasma glucose level (mg/dl)		
≤ 150	31 (83.8%)	137 ± 92
> 150	06 (16.2%)	

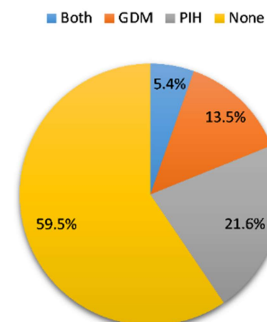


Figure 1: Comorbid illness status in the study population

Table 1 summarizes various characteristics of patients including laboratory investigations.

Among comorbid illnesses, PIH alone was the most frequent comorbidity in 08 (21.6%) followed by GDM alone in 05 (13.5%), and both PIH and GDM in 02 (5.4%) as shown in Figure 1.

Comorbid illness was reported in 05 (55.6%) primigravid women and 10 (35.7%) multigravida women with a p-value of 0.292. When maternal outcomes were assessed, a significantly higher frequency of cesarean delivery was observed in 09 (64.3%) women with comorbid illnesses as compared to 05 (35.7%) women without any comorbid illness with a p-value of 0.022. Among 14 (37.8%) cesarean delivery cases, 05 (22.7%) were without comorbidity, 01 (20.0%) had GDM alone, 06 (75.0%) had PIH alone, and

Table 2: Maternal outcomes in women with and without comorbid illness

Characteristics	Total (n=37)	Comorbid illness		p-value
		No (n=22)	Yes (n=15)	
Mode of delivery				
Normal	23 (62.2%)	17 (73.9%)	06 (26.1%)	0.022
Cesarean	14 (37.8%)	05 (35.7%)	09 (64.3%)	
ICU admission requirement	29 (78.4%)	16 (55.2%)	13 (44.8%)	0.312
Supplementary O ₂ requirement	37 (100.0%)	22 (59.5%)	15 (40.5%)	-
Non-invasive mechanical ventilation requirement	13 (35.1%)	07 (53.8%)	06 (46.2%)	0.609
Invasive mechanical ventilation requirement	14 (37.8%)	08 (57.1%)	06 (42.9%)	0.823
Maternal mortality	02 (5.4%)	0 (0.0%)	02 (100%)	0.078
Duration of hospitalization [mean±SD (days)]	6.7±3.0	5.6±1.6	8.2±3.8	0.009

Table 3: Fetal outcomes in women with and without comorbid illness

Characteristics	Total (n=37)	Comorbid illness		p-value
		No (n=22)	Yes (n=15)	
Apgar score at 1 minute				
≥7	15 (40.5%)	08 (53.3%)	7 (46.7%)	0.531
<7	22 (59.5%)	14 (63.6%)	8 (36.4%)	
Apgar score at 5 minutes				
≥7	36 (97.3%)	22 (61.1%)	14 (38.9%)	0.220
<7	1 (2.7%)	0 (0.0%)	1 (100%)	
Amniotic fluid volume				
Adequate	17 (45.9%)	12 (70.6%)	5 (29.4%)	0.253
Polyhydramnios	1 (2.7%)	0 (0.0%)	1 (100%)	
Decreased	15 (40.5%)	9 (60.0%)	6 (40%)	
Normal	2 (5.4%)	0 (0.0%)	2 (100%)	
Excessive	2 (5.4%)	1 (50.0%)	1 (5%)	
Placental localization				
Low lying	6 (16.2%)	5 (83.3%)	1 (16.7%)	0.193
Upper segment	31 (83.8%)	17 (54.8%)	14 (45.2%)	
Birth weight				
≥2500g	30 (81.1%)	21 (70%)	9 (30%)	0.007
<2500g	7 (18.9%)	1 (14.3%)	6 (85.7%)	
NNU admission requirement	20 (54.1%)	8 (40%)	12 (60%)	0.009
Neonatal mortality	2 (5.4%)	0 (%)	2 (100%)	0.078

02 (100%) had both GDM & PIH. The frequency of maternal mortality 02 (100%) was observed only in women with comorbid illnesses with a p-value of 0.078. One of them had a normal delivery and the other had a cesarean delivery. The mean duration of hospitalization was 8.2 ± 3.8 days in women with comorbid illnesses significantly longer than 5.6 ± 1.6 days in women without any comorbid illness with a p-value of 0.009 (Table 2).

When fetal outcomes were assessed, a significantly higher frequency of low birth weight 06 (85.7%) was observed in women with comorbid illnesses as compared to 01 (14.3%) in women without any comorbid illness with a p-value = 0.007. Among 07 (18.9%) low birth weight cases, 01 (4.5%) was without comorbidity, and 06 (75%) had PIH alone. A significantly higher frequency of NNU admission requirement of 12 (60%) was observed in women with comorbid illnesses as compared to 08 (40%) in women without any comorbid illness with a p-value of 0.009.

The frequency of neonatal mortality 02 (100%) was observed only in women with comorbid illnesses with a p-value of 0.078. One of them had a normal birth weight and the other had a low birth weight (Table 3).

DISCUSSION

COVID-19 affects pregnancy outcomes by escalating numbers of adverse events during pregnancy, birth and postpartum.⁷ Virk and colleagues reported that COVID-19 during gestation was related to a higher risk of complications and maternal mortality.⁸ Likewise, Dash and coworkers from India reported that COVID-19 during pregnancy either with or without any comorbidity can develop complications among both mother and fetus irrespective of treatment.⁹ Conversely, Munir and co-researchers from Lahore Pakistan reported that COVID-19 in pregnant women was not dissimilar from in the general population. Moreover, fetomaternal outcomes were overall good, and vertical transmission was not observed.¹⁰ In the same way,

Zehra and coworkers from Karachi Pakistan reported that COVID-19-positive mothers did not show adverse maternal or neonatal outcomes greater than COVID-19-negative mothers.¹¹

The review of the literature showed that the progression of COVID-19 during gestation is similar to that in non-pregnant women. However, the risk of unsolicited fetomaternal outcomes is enigmatic among pregnant women with COVID-19.¹² On the contrary, PIH and GDM lead to poor fetomaternal outcomes.^{13,14} For this reason, we evaluated the impact of comorbid PIH and GDM on fetomaternal outcomes in COVID-19-positive women hospitalized for delivery. Besides some inherent limitations of the present study including retrospective observational design, small sample number, single-centre setting, and short study duration, we found that women with comorbid illness had more adverse maternal and neonatal outcomes and longer hospital stays than their counterparts. With some variations in terms of comorbid diseases, our findings are consistent with the results of other studies. As Smith and colleagues reported, women with previous comorbid hypertension, diabetes or cardiovascular disease compared to those without any comorbidity had a higher risk for COVID-19 intensity and poor pregnancy outcomes including premie, low birthweight and mortality.¹⁵ Vouga and colleagues also reported that diabetes, hypertensive disorders and pulmonary comorbidities were revealed as risk factors for developing serious COVID-19 complications in pregnant women. Furthermore, obstetric and neonatal outcomes appeared to be affected by the severity of maternal illness.¹⁶ Ghelichkhani and colleagues from West Iran reported that the risk of preterm labor, preeclampsia and eclampsia was significantly greater in COVID-19-positive pregnant women with underlying diseases admitted to the hospital for delivery.¹⁷

CONCLUSION

Patients having comorbid PIH and GDM had a higher incidence of adverse fetomaternal outcomes and longer hospital stays among COVID-19-positive women hospitalized for delivery. These findings suggest that women with comorbid illness require personalized treatment to prevent or decreasing the incidence of adverse pregnancy outcomes. The increase in diabetes risk in pregnant women with COVID-19, active monitoring of glucose dysregulation is warranted. In addition, research on social determinants of health related to adverse fetomaternal outcomes and factors

would be crucial for developing strategies for managing and preventing disease in future pandemics.

REFERENCES

1. Hassan MM, Tahir MH, Ameer M, Jamal F, Mendy JT, Chesneau C. Risk factors identification of COVID-19 patients with chronic obstructive pulmonary disease: A retrospective study in Punjab-Pakistan. *Immun Inflamm Dis*. 2023;11(8):e981. doi: 10.1002/iid3.981.
2. Mota M, Huerta-Álvarez C, Llorente A, Cea-Soriano L. The risk of SARS-CoV-2 infection in pregnant women: an observational cohort study using the BIFAP Database. *Healthcare (Basel)*. 2022;10(12):2429. doi: 10.3390/healthcare10122429.
3. Ghi T, di Pasquo E, Mekinian A, Calza L, Frusca T. Sars-CoV-2 in pregnancy: Why is it better than expected? *Eur J Obstet Gynecol Reprod Biol*. 2020;252:476-8. doi: 10.1016/j.ejogrb.2020.07.025.
4. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. *Lancet*. 2020; 395(10229):1054-62. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3).
5. World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). 30 January 2020 (accessed 15 March 2024). Available from: [https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)).
6. Hui DS. Epidemic and Emerging Coronaviruses (Severe Acute Respiratory Syndrome and Middle East Respiratory Syndrome). *Clin Chest Med*. 2017;38(1):71-86. <https://doi.org/10.1016/j.ccm.2016.11.007>.
7. Gholami R, Borumandnia N, Kalhori E, Taheri M, Khodakarami N. The impact of covid-19 pandemic on pregnancy outcome. *BMC Pregnancy Childbirth*. 2023;23(1):811. <https://doi.org/10.1186/s12884-023-06098-z>.
8. Virk S, Gangu K, Nasrullah A, Shah A, Faiz Z, Khan U, et al. Impact of COVID-19 on pregnancy outcomes across trimesters in the United States. *Biomedicine*. 2023;11(11):2886. <https://doi.org/10.3390/biomedicine11112886>.
9. Dash P, Padhi SK, Behera RN. Observational study of fetomaternal outcome in pregnancy with COVID-19 infection. *Int J Reprod Contracept Obstet Gynecol*. 2022;11(3):752-9. <https://dx.doi.org/10.18203/2320-1770.ijrcog20220391>.
10. Munir SI, Ahsan A, Iqbal S, Aslam S, Tahira T, Alqai S. Fetomaternal outcome in women with COVID-19 in a COVID designated hospital in Lahore, Pakistan. *Biomedica* 2020; 36(S2):228-34. Available from: <http://www.thebiomedicapk.com/articles/754.pdf>
11. Zehra SM, Parkar S, Kazi Z, Pethani A, Malik A, Mirza A, et al. Impact of COVID-19 on feto-maternal and neonatal health in Karachi, Pakistan, A retrospective cohort study. *PLOS Glob Public Health*. 2023;3(8):e0002139. <https://doi.org/10.1371/journal.pgph.0002139>.
12. Shree P, Mittal N, Vishwakarma S, Verma V, Pandey V, Thadani E. Maternal and perinatal outcomes of COVID-19-positive pregnant women. *Cureus*. 2022;14(6):e26411. <https://doi.org/10.7759/cureus.26411>.
13. Syoum FH, Abreha GF, Teklemichael DM, Chekole MK. Fetomaternal outcomes and associated factors among mothers

- with hypertensive disorders of pregnancy in Suhul Hospital, Northwest Tigray, Ethiopia. *J Pregnancy*. 2022;2022:6917009. <https://doi.org/10.1155/2022/6917009>
14. Ye W, Luo C, Huang J, Li C, Liu Z, Liu F. Gestational diabetes mellitus and adverse pregnancy outcomes: systematic review and meta-analysis. *BMJ*. 2022;377:e067946. <https://doi.org/10.1136/bmj-2021-067946>.
 15. Smith ER, Oakley E, Grandner GW, Rukundo G, Farooq F, Ferguson K, et al. Clinical risk factors of adverse outcomes among women with COVID-19 in the pregnancy and postpartum period: a sequential, prospective meta-analysis. *Am J Obstet Gynecol*. 2023;228(2):161-77.
 16. Vouga M, Favre G, Martinez-Perez O, Pomar L, Acebal LF, Abascal-Saiz A, et al. Maternal outcomes and risk factors for COVID-19 severity among pregnant women. *Sci Rep*. 2021;11(1):13898.
 17. Ghelichkhani S, Jenabi E, Jalili E, Alishirzad A, Shahbazi F. Pregnancy outcomes among SARS-CoV-2-infected pregnant women with and without underlying diseases: a case-control study. *J Med Life*. 2021;14(4):518-22.