Original Article

Maternal and Neonatal Outcome of Pregnant Women with Coronavirus (COVID-19) at Mansoura University Hospital

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ABSTRACT

Objective: This study aimed to evaluate maternal and fetal outcome of pregnant women with coronavirus (COVID-19).

Methods: This prospective cohort study was conducted on a group of pregnant females diagnosed to have COVID-19. Primary outcomes included maternal mortality rate. Secondary outcomes included gestational age (GA) at time of admission, mode of termination of pregnancy, hospital stay, perioperative complications, neurological complications, post-partum hemorrhage, and puerperal sepsis, and fetal outcomes which included vertical transmission, admission to NICU, APGAR SCORE at 0.5min and Fetal weight.

Results: The presenting symptoms in the females was Cough in 100%, dyspnea in 98.6%, fatigue in 80%, fever in 65.7%, loss of taste in 17.1%, loss of smell in 12.9% and diarrhea in 2.9%. Regarding the computed tomography findings in the included cases, CORAD 2 was reported in 7.1%, CORAD 3 in 38.6%, CORAD 4 in 21.4%, CORAD 5 in 28.6% and CORAD 6 in 4.3%. The reported maternal complications were Lung problems in 8 case, postoperative fever in 2 cases, wound infection in 1 case, deep venous thrombosis (DVT) in 1 case and Pulmonary embolism in 1 case. The mean APGAR score 1 minute was 5.78±2.17. The mean APGAR score 5 minutes was 6±2.06. There were 35 preterm neonates and 14 neonates who were admitted into NICU.

Conclusion: This study highlighted the significant impact of COVID-19 on pregnant women, with a high rate of cesarean sections, maternal complications, and a 21.4% mortality rate. Neonatal outcomes were also affected, with presence of preterm births and NICU admissions.

Key Words: Apgar Score; Coronavirus; Pregnant Women.

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INTRODUCTION

Coronavirus disease is a new disease with rapidly increasing in cases and fatalities. World Health Organization has declared COVID-19 a public health emergency of global concern since the outbreak of COVID-19 pneumonia in Wuhan, China[1]. After the appearance of SARS-CoV and MERS-CoV, SARS-CoV-2 is the 3rd zoonotic human coronavirus in this century[2].

Coronaviruses cause a variety of illnesses, from a simple cold to severe respiratory distress and death. Close contact with infected patients within two weeks of symptom onset is currently one of the key epidemiologic predisposing factors for coronavirus illness (2019). The mean incubation period is 5 days. The mean age of hospitalized cases is 49-56 years, with a third to half with an underlying disease and continuing to be infectious 14 days following cessation of manifestation[3].

Hospitalized patients were more common among men (54-73 %). Common symptoms are fever, cough, muscle aches, headaches and diarrhea. Abnormal investigations include chest *x*-ray abnormalities, lymphopenia, leukopenia, and thrombocytopenia[4].

During infectious disease epidemic, pregnant females and their offsprings are a high-risk group at the onset of infection and there is no well-established data regarding vertical transmission. Physiologic and mechanical alterations throughout pregnancy in general increase vulnerability to infections and increase abrupt progression to respiratory failure during pregnancy, especially if the cardiopulmonary systems are affected. In addition, the distortion of pregnancy to the predominance of the *T*-helper 2(Th2) system that protects the fetus makes the mother more liable to viral infections. Viral infections are more efficiently contained by the Th1 system. These distinctive

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challenges require an integrated approach to SARS- CoV-2 affected pregnancies[5]. It has been demonstrated that pregnant women are more susceptible to complications like preterm birth or stillbirth. About 2/3 of pregnant females with COVID-19 are asymptomatic[6]. So, the current study aimed to evaluate maternal and fetal outcome of pregnant women with coronavirus (COVID-19) at the time of application of treatment protocol approved by Egyptian ministry of health and higher ministry of education.

PATIENTS AND METHODS

This prospective cohort study was conducted on a group of pregnant females diagnosed to have COVID-19 at different gestational ages (GA) confirmed with nasopharyngeal swab and or CT chest. Patients were collected from obstetrics and gynecology Department in isolation hospitals in Mansoura university hospitals within the period from October 2021 to October 2022. We excluded cases with mild symptoms and isolated at home.

All cases were subjected to history taking including personal history (age, residence, work, and complain), menstrual history, obstetric history (gravidity, parity, abortions, still birth, ectopic pregnancy, past medical history, past surgical history) and family history.

General and obstetric examination included assessment of appearance, complexion, decubitus, and vital signs (pulse, blood pressure, temperature, respiratory rate and oxygen saturation). Laboratory investigations included complete blood count, C-reactive protein, D-dimer, ABG, renal and liver function test and nasopharyngeal swab. CT Chest was done if needed. Ultrasound was done to assess the fetal wellbeing. Treatment plan was according to Egyptian ministry of health protocol. type of anesthesia used were General anesthesia, spinal anesthesia, or combined spinal and general anesthesia

Outcome Measures:

Primary outcomes included maternal mortality rate (MMR) which is defined as the number of maternal deaths during a given time period per all pregnant woman entered Mansoura university isolation hospital during the same time. Secondary outcomes included gestational age at time of admission, mode of termination of pregnancy, hospital stay (the period when a person is admitted to a hospital for medical treatment or observation), preoperative complications as hypoxia, pneumonia, fever, respiratory distress, and kidney injury, operative complications as respiratory distress, sever blood loss, cardiac arrest, bowel injury, bladder injury, and adhesions, post operative complications as cardiac complications, respiratory complication, deep venous thrombosis (DVT) and pulmonary embolism, fever, neurological complication, post-partum hemorrhage, and puerperal sepsis, and fetal outcomes which included vertical transmission, admission to NICU, APGAR SCORE at 0.5min and Fetal weight.

Ethical Considerations:

Study design was approved by Institutional Research Board (IRB), at Mansoura University. Approval of the mangers of the health care facilities in which the study was conducted. Informed verbal consent was obtained from all participants. Confidentiality was respected. Collected data wasn't used for any other purpose.

Statistical analysis:

Data was analyzed using SPSS version 22. Qualitative data will be presented as number and percent, Quantitative data was tested for normality by Shapiro-Wilk test then described as mean and SD for normally distributed data and median and range for non- normally distributed. Paired samples *t*-Test was utilized to evaluate the statistical significance of the difference between two dependent study group with parametric data. Wilcoxon Test was utilized to assess the statistical significance of the difference between two dependent study group with non-parametric data. *P*-values <0.05 are significant.

RESULTS

The current study included 70 pregnant females diagnosed to have COVID-19. that the mean age of the females was 34.66±6.52 years with range between 17 and 47 years. The mean GA at admission was 34.71±5.06 weeks with range between 9 and 39 weeks. The mean GA at termination was 35.71±4.83 weeks with range between 9 and 39 weeks. The median number of gravidity was 3 (range from 1 to 6), the median number of parity was 2 (from zero to 4), the median number of Previous full term normal delivery was zero (from zero to 3), the median number of previous CS was 2 (from zero to 3) and the median number of previous abortion was zero (from zero to 3). Previous preterm labour was shown in one female only (1.4%) and previous IUFD was also reported in one case (1.4%) (Table 1).

Table 1: Basic data, and Obstetric history in the studied cases:

Variables	**Study cases *N*= 70**	
	Mean±SD	Median (Range)
Age (years)	34.66±6.52	35(17–47)
GA at admission (Weeks)	34.71±5.06	36(9–39)
GA at termination (Weeks)	35.71±4.83	36(9–39)
	Number(N)	Percent(%)
Medical disorders during pregnancy		
Gestational DM	11	15.7%
Gestational hypertension	9	12.9%
Fatty liver during pregnancy	1	1.4%
Obstetric cholestasis	1	1.4%
Peripartum cardiomyopathy	1	1.4%
Placenta previa complete centralis	1	1.4%
Preeclampsia	1	1.4%

Variables	Study cases *N*= 70	
Gestational Thrombocytopenia	1	1.4%
Previous preterm labour	1	1.4%
Previous IUFD	1	1.4
Gravidity	3(1–6)	
Parity	2(0–4)	
Previous full term normal delivery	0(0–3)	
Previous CS	2(0–3)	
Abortion	0(0–3)	

The mean SBP (mmHg) was 117.54±15.57 with range between 90–160, the mean DBP (mmHg) was 73±11.27 with range between 50–110, the mean pulse rate (B/min) was 96.63±14.41 with range between 66–133, the mean RR (Cycle/min) was 26.46±6.34 with range between 15–52 and the mean oxygen saturation (%) was 91.13±7.72 with range between 65–99. The presenting symptoms in the females was Cough in 100%, dyspnea in 98.6%, fatigue in 80%, fever in 65.7%, loss of taste in 17.1%, loss of smell in 12.9% and diarrhea in 2.9%. Regarding the computed tomography findings in the included cases, CORAD 2 was reported in 7.1%, CORAD 3 in 38.6%, CORAD 4 in 21.4%, CORAD 5 in 28.6% and CORAD 6 in 4.3%. All the cases received Antipyretics, Anticoagulants, Antibiotics and Steroids. While 68 cases (97.1%) received vitamin C and 61 cases (87.1%) received antiviral (Table 2).

Table 2: Clinical evaluation and CT disease severity at time of admission and protocol of treatment:

Variables	Study cases *N*= 70	
	Mean±SD	Median (Range)
SBP (mmHg)	15.57 ± 117.54	116 (90–160)
DBP (mmHg)	73±11.27	70(50–110)
Pulse (B/min)	96.63±14.41	96(66–133)
RR (Cycle/min)	26.46±6.34	26(15–52)
O2 saturation (%)	91.13±7.72	93(65–99)
	Number(*n*)	Percent(%)
Symptoms		
Cough	70	100%
Dyspnea	69	98.6%
Fatigue	56	80%
Fever	26	65.7%
Loss of taste	12	17.1%
Loss of smell	9	12.9
Diarrhea	2	2.9%
CT disease severity		
CORAD 2	5	7.1%
CORAD 3	27	38.6%
CORAD 4	15	21.4%
CORAD 5	20	28.6%
CORAD 6	3	4.3%
Protocol of Treatment		
Antipyretics	70	100%
Anticoagulants	70	100%
Antibiotics	70	100%
• 3rd generation cephalosporin	67	95.7%
• Azithromycin	28	40%
• Clarithromycin	19	27.1%
• Carbebenem	14	20%
• Mitronidazole	15	21.4%
• 4th generation cephalosporin	8	11.4%
• Levofloxacin	18	25.7%
• Ambicillin +sulbactam	7	10%
• Rametax	4	5.7%
• Ciprofloxacin	1	1.4%
• Linezolid	7	9.9%
• Fluroquinolone	1	1.4%
Steroids (dexamethasone)	70	100%
Vitamin c	68	97.1%
Antiviral (Remdsvir)	61	87.1%

Continuous data expressed as mean±SD and median (range); Categorical data expressed as Number(%).

There was a significant increase in the WBCs count, lymphocyte count and HCO3 after treatment as compared to their values at admission. In contrast, there was a significant decrease in the neutrophil count, AST (SGOT) level and PH after treatment as compared to their values at admission. Other values show no significant difference (Table 3).

AS the mode of pregnancy termination, CS was conducted in 90%, D and C evacuation was performed in 2.9% and normal delivery in 5.7%. Regarding the need for ventilation, CPAP was required in 5.7%, invasive mechanical ventilation (MV) in 18.6%, non-invasive ventilation in 10%, with oxygen in 38.6% and without oxygen in 24.3%. General anesthesia was required in 41.4% and regional anesthesia in 54.3%. Intrapartum analgesia was required in 4 cases, epidural analgesia in 2 cases (2.9%) and local analgesic infiltration in 2 cases (2.9%). The reported maternal complications were Lung problems in 8 case (11.4%), postoperative fever in 2 cases (2.9%), wound infection in 1 case (1.4%), DVT in 1 case (1.4%) and Pulmonary embolism in 1 case (1.4%). The incidence of mortality was 21.4% (Table 4).

The mean birth weight was 3018.96±368.01 gm with range between 1800 and 3700gm. The mean APGAR score 1 minute was 5.78±2.17 with range between 1 and 8. The mean APGAR score 5 minutes was 6±2.06 with range between 1 and 9. There were 35 preterm neonates (52.2%) and 14 neonates (20.9%) who were admitted into NICU (Table 5).

Table 3: Analysis of laboratory findings in the two study groups:

	At admission (*N*= 70)	Postoperative (*N*= 70)	Test of significance	*P* value
HGB (gm/dl)	11.07±1.33	10.85±1.08	*t*= 1.817	0.074
HCT	33.77±3.97	33.09±4.09	*t*= 1.296	0.199
WBCs (10^3/cmm)	8.7(2.39–31.2)	10.26(4.37–37.1)	*z*= - 2.879	0.004*
PLTs (10^3/cmm)	247(106–831)	282(20–675)	*z*= -1.845	0.065
ALT (U/L)	29(5–359)	28(5–126)	*t*= -1.141	0.254
AST (U/L)	32(3–281)	28(5–202)	*t*= - 2.752	0.006*
Creatinine	0.69±0.27	0.71±0.30	*t*= -0.573	0.568
PH	7.40±0.05	7.38±0.08	*t*= 2.652	0.010*
PCO2 (mmHg)	33.60±9.49	36.24±12.04	*t*= -1.543	0.151
HCO3 (meq/L)	21.66±2.83	22.98±4.80	*t*= -2.231	0.023*
Lymphocytes	0.13(0.01–0.45)	0.18(0.018–0.40)	*z*= - 2.143	0.032*
Neutrophils	0.78±0.08	0.73±0.12	*t*= 3.184	0.002*
INR	1.08±0.25	1.05±0.26	*t*= 0.523	0.602

t: Paired samples *t*-test; *z*: Wilcoxon Signed rank-test; *: Statistically significant (p<0.05).

Table 4: Maternal follow up and complications in the cases of the study:

Variables	Study cases *N*= 70	
	Mean±SD	Median (Range)
GA at termination (Weeks)	35.71 ±4.83	36(9-39)
Mode of termination	Number (*N*)	Precentage(%)
CS	63	90.0%
D and C evacuation	2	2.9%
Normal delivery	4	5.7%
Need for ventilation		
CPAP	4	5.7%
invasive mechanical ventilation	13	18.6%
Non-invasive ventilation	7	10.0%
With oxygen	28	38.6%
Without oxygen	18	24.3%
Anaesthesia		
General	29	41.4%
Regional	38	54.3%
Intrapartum analgesia		
Epidural analgesia	2	2.9%
Local analgesic infiltration	2	2.9%
Maternal Complications		
Lung problems	8	11.4%
Postoperative fever	2	2.9%
Wound infection	1	1.4%
DVT	1	1.4%
Pulmonary embolism	1	1.4%
Postpartum hemorrhage	0	0%
Urine retention	0	0%
Reaction to anaesthesia	0	0%
Overall survival		
Survived	55	78.6%
Maternal Mortality	15	21.4 %

Categorical data expressed as Number (%); CS: Caesarean section; D and C: Dilatation And curettage; CPAP: Continuous positive airway pressure; DVT: Deep venous thrombosis.

Table 5: Fetal outcome in the studied cases:

Variables	Study cases (Neonates) *N*= 67	
	Mean±SD	Median (Range)
Birth weight (gm)	368.01 ± 3018.96	3100(1800–3700)
APGAR score 1 minute	2.17 5.78	7(1–8)
APGAR score 5 minutes	6±2.06	7(1–9)
	Number(*N*)	Percent(%)
Preterm labor	35	52.2%
NICU admission	14	20.9%

Continuous data expressed as mean±SD and median (range); Categorical data expressed as Number(%); NICU: Neonate intensive care unit.

DISCUSSION

There are serious concerns about pregnancy during the COVID-19 pandemic about maternal and neonatal outcomes. Pregnant women with COVID-19 may have an increased risk of developing complications compared with non-infected pregnant women. Studies have recorded that infected women have a high incidence of preeclampsia (PE), preterm birth, and cesarean delivery. Severe cases of COVID-19, particularly in the third trimester, may need hospitalization and intensive care, especially among pregnant women with pre-existing pathological conditions like obesity, hypertension (HTN), or diabetes. Despite this risk, a majority of pregnant women infected with COVID-19 recover uneventfully with proper medical care[7]. The current study aimed to evaluate maternal and fetal outcome of pregnant women with coronavirus (COVID-19) at the time of application of treatment protocol approved by Egyptian ministry of health and higher ministry of education.

This prospective study was conducted on 70 pregnant women diagnosed with COVID-19 at various ages of gestation and admitted to Mansoura University isolation

hospitals from October 2021 to October 2022. The age of the mother in the current research was 34.66 years on average. in Youssef *et al*.,[8], the age of the patients ranged from 18 to 43 years, and the mean age was 30.43±6.12 years. Similarly, Ibrahim *et al*.,[9], in their study of 75 COVID-19 pregnant women, indicated a range between 19 and 43 years and a mean of 29.11±5.77 years. Hashem *et al.,*[10] also reported a mean maternal age of 27.03±5.19 years.

In this study, gestational age upon admission was 34.71 weeks and upon termination was 35.71 weeks. The above findings are in agreement with Youssef *et al.,*[8], who explained that most of the cases (76.1%) were diagnosed with COVID-19 during the third trimester, followed by 10.9% at the time of delivery, and 6.5% during the first and second trimesters. This distribution pattern allows for the assumption that the third trimester poses the highest risk of complication, most likely due to significant physiological change in the immune and respiratory systems that happen during late pregnancy[11].

The most frequent medical conditions during pregnancy in our research were HTN (12.9%) and gestational diabetes (15.7%), with some single cases of complications like PE and peripartum cardiomyopathy. In agreement, Youssef *et al.,*[8], indicated comorbidities such as cardiac disorders (6.2%), gestational and chronic diabetes, chronic and gestational HTN, and PE in pregnant women infected with COVID-19. Other conditions among their study comprised anemia, retinopathy, thrombocytopenia, ovarian cysts, and history of thyroidectomy. Similarly, Yee *et al.,*[12] have indicated that among pregnant COVID-19 women, 4.2% had diabetes, and 3.7% had hypertension, including pregnancy-induced hypertension.

During this study, cough (100%), dyspnea (98.6%), and fatigue (80%) were the commonest presenting manifestations in pregnant females with COVID-19, while fewer presentations had fever (65.7%) and loss of taste or smell. The mean vital signs on presentation included a mean systolic blood pressure of 117.54mmHg, diastolic pressure of 73mmHg, and pulse rate of 96.63 beats/minute.

These findings are slightly lower than those recorded by Allotey *et al*.,[13] in a meta-analysis of 192 studies and 67,271 pregnant and recently pregnant women. The study found that 10% of the women were suspected or confirmed to have COVID-19, and fever (40%) and cough (41%) were most frequently reported as symptoms. Compared with women who were not pregnant and were in the reproductive age group, pregnant women were less likely to have symptoms of or report fever, dyspnea, and myalgia.

In this study, the cesarean section was the predominant mode of delivery, performed in 90% of cases, followed by vaginal delivery in 5.7% and dilation and curettage (D and C) in 2.9%. Respiratory support was required in 34.3% of patients, with 18.6% needing invasive mechanical ventilation and 5.7% requiring CPAP. Reported maternal complications included pulmonary issues in 11.4% of cases, postoperative fever in 2.9%, wound infection in 1.4%, and DVT and pulmonary embolism in 1.4% each.

Our findings align with those recorded by Youssef *et al.,*[8], who demonstrated that 37.2% of pregnant females with COVID-19 needed admission to the intensive care unit, 5.2% underwent MV, and the maternal mortality rate reached 15.9%. These outcomes reflect the increased risks associated with COVID-19 in pregnancy, likely influenced by limited prenatal care, elevated psychological stress, and insufficient social support.

Bellos *et al*.,[14], in a meta-analysis, found comparable results, reporting 11% ICU admissions and a lower maternal mortality rate of 1.3%. Neonatal complications in their study included prematurity (13%), fetal distress (10.9%), respiratory distress syndrome (8.7%), and jaundice in isolated cases. In contrast, Salem *et al*.,[11] reported favorable outcomes in most cases, with no maternal fatalities and 94% of patients discharged without complications.

In the present study, the maternal mortality rate was found to be 21.4%, which is very high compared to findings in several other regional and international studies. However, Atak *et al*.,[15] conducted a study in Turkey among unvaccinated pregnant and postpartum women who were admitted to intensive care units. Their findings reported an even higher maternal mortality rate of 34.6%, highlighting the profound impact of COVID-19 in critically ill, high-risk patients. Similarly, Youssef *et al*.,[8] reviewed outcomes in an Egyptian isolation ward and found a maternal mortality rate of 15.9% in 75 COVID-positive pregnant women, which, while lower than in the current study, still indicates a significant risk in these settings.

In comparison, more comprehensive international studies reported much lower mortality rates. A systematic review and meta-analysis of 117 studies including 11,758 pregnant women with COVID-19 by Karimi *et al*.,[16] estimated a pooled maternal mortality rate of only 1.3%. This much lower rate corresponds to the average risk for heterogeneous populations and healthcare systems, not for high-risk or ICU-admitted patients specifically.

Also, Ibrahim *et al*.,[9] reported no maternal death among 75 COVID-19-positive pregnant women. They did report, however, high maternal and neonatal complications, including 6.25% neonatal mortality, miscarriage, and repeat NICU admissions, which pointed to the general morbidity risk of maternal infection.

The mean birth weight within the study being examined was 3019 grams. 52.2% of the neonates were preterm and 20.9% required NICU admission. The findings are in

agreement with several new studies assessing the effect of maternal COVID-19 on neonatal outcome. Another study conducted by Marchand *et al*.,[17] revealed a preterm birth rate and low birth weight of 16.7% in neonates born to COVID-19-positive mothers. Similarly, Giuliani *et al.,*[18] revealed that maternal COVID-19 exposure during pregnancy significantly increased the risk of NICU admission, preterm birth, and low birth weight.

In yet another recent research, Sisman *et al.,*[19] observed that neonates born to mothers with moderate to severe COVID-19 infection were preterm, with lower birth weight, and required NICU treatment. These observations highlight the potential severity of maternal COVID-19 on neonatal health. On the contrary, Li *et al*.,[20] reported improved outcomes, whereby none of the neonates became infected with COVID-19, no respiratory failures occurred among hospitalization, and no severe neonatal complications were observed among babies born by infected mothers.

This study found a greater incidence of maternal mortality among pregnant women with COVID-19 compared to what most other research has reported. While some foreign studies found lower risks for pregnant women overall, our results are consistent with other research in hospitals that get more critical or severe cases. This means that the risk of poor outcomes is perhaps greater in women who are already ill, especially those in late pregnancy or who have other medical problems like high blood pressure or diabetes. Our findings also showed that babies who were born to mothers with COVID-19 were also more likely to be premature, have lower birth weights, or need to be treated in the NICU. These are similar to what many other studies have also found, especially if the mother was more severely infected. In general, our study confirms the theory that COVID-19 during pregnancy could lead to critical complications in both mothers and babies, especially in advanced cases. This suggests the need for careful surveillance, proper medical care, and prompt treatment to help improve outcomes.

CONCLUSION

This study highlighted the significant impact of COVID-19 on pregnant women, with a high rate of cesarean sections, maternal complications, and a 21.4% mortality rate. Neonatal outcomes were also affected, with a substantial proportion of preterm births and NICU admissions. The findings underscore the need for continued research and tailored management protocols for pregnant women with COVID-19.

CONFLICT OF INTERESTS

There is no conflict of interests.

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