

## RESEARCH ARTICLE

# Maternal and neonatal outcomes in COVID-19 infected pregnancies : a prospective cohort study

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## ABSTRACT

**Objective:** To study maternal and neonatal outcome in COVID -19 positive pregnant women. **Methodology:** Prospective cohort study was done in a tertiary maternity unit in Hind Institute of Medical Sciences, level 2 COVID care centre. Data was analyzed for a cohort of 49 pregnant women tested positive for COVID-19 between 14/8/2020 and 20/10/2020 to assess the effect of COVID-19 on pregnancy and neonatal outcomes. **Results:** Among 49 women, 14 women (28.57%) had mild symptoms, while 34 women (69.38%) were asymptomatic, 1 (2.04%) had moderate severity. 6 women had co-morbidities (12.24%). 46 women underwent delivery and 2 women (4.08 %) underwent abortion. Out of the 46 deliveries conducted 38 (82.60%) underwent C - section, 1 (2.17 %) had exploratory laparotomy and 7 (15.21%) had normal delivery. Most frequent indication for performing C-section was fetal distress in 25 women (54.34%). In per-operative findings of C-section conducted 20 women (51.28%) were having meconium stained liquor. Other important per-operative finding was thinned out lower segment in all 11 pregnancies with previous scar, 5 women (12.8%) had atonic PPH. There were two ICU (4.08%) admissions and 1 maternal mortality (2.04%). Amongst 46 delivered neonates, 2 were still born (4.34 %) 2 IUD (4.34%), 13 preterm (28.26%), 3 IUGR (6.52%). 3 (6.52%) neonates required NICU admissions for management. All babies were negative for COVID-19 after 5 days of delivery. **Conclusion:** In our study we found higher rates of C-section in COVID positive pregnant women, severity of disease was not affected by pregnancy and there was no COVID associated mortality. Seroreversion to COVID negative status was 100% after 10 days. There was higher incidence of preterm, PROM, meconium stained liquor. We found no evidence of vertical transmission.

**Keywords:** COVID-19, pregnancy, antenatal, symptoms, C section, vertical transmission, mortality.

Humanity has witnessed its first ever worldwide pandemic of corona virus COVID-19, which originated in Wuhan, China, in December 2019<sup>1</sup>. Earlier similar corona virus infections have been reported like MERS (middle east respiratory syndrome) and SARS (severe acute respiratory syndrome)<sup>2</sup> is caused by corona virus strain SARS COV 2<sup>3</sup>. India reported the first confirmed case of the COVID-19 on 30 January 2020 in Kerala state. By the end of December 2020 total number of cases in India were 1,02,66,674 with mortality of 1,48,738<sup>4</sup>.

Pregnancy is a state of altered immunity<sup>5</sup> and COVID-19 is causing significant morbidity and mortality in dys-

regulated immunological states like diabetes<sup>6,7</sup>. There is no previous data available of COVID-19 impact on pregnancy, however infection in pregnant with other strains of corona virus like SARS and MERS showed increased risk of preterm birth, stillbirth, miscarriage<sup>8,9</sup>. This pandemic brought changes in routine antenatal check up norms, because of various restrictions imposed, to curtail its spread. Guidelines are formulated and are continuously being upgraded on basis of variable presentations and course of disease. There has been marked impact on ANC (antenatal care) services because of limited number of ANC visits, only most essential and urgent investigations being done and

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physical presence being replaced by telemedicine <sup>10</sup>.

We have conducted our study on COVID-19 infected pregnant women. Our study aims to assess various maternal and neonatal outcomes that are directly or may be indirectly associated with COVID -19 infection in pregnant population. We require more such data to gear up and update our management thus having more preparedness for future. We hope findings of our study will contribute for the same.

**Materials and methods**

Total 49 COVID-19 positive pregnant women were admitted during duration of 2 months between 14/8/2020 and 20/10/2020, in maternity unit of COVID centre Hind Institute of Medical Sciences Barabanki, declared level 2 nodal centre by government. These were known COVID positive pregnant women with COVID antigen/RTPCR test positive, referred from other centers for admission in Hind hospital. We collected their prospective demographic and clinical information at time of admission as well as during their stay.

**Inclusion criteria:** All symptomatic/asymptomatic antenatal COVID-19 positive women referred and admitted to our centre by district authority.

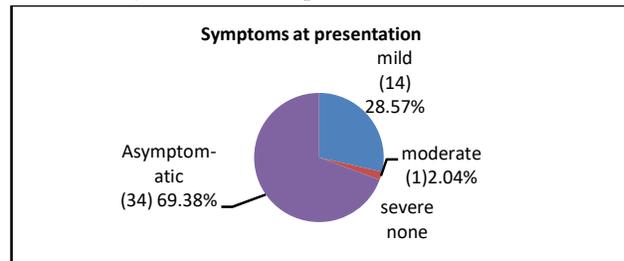
**Exclusion criteria:** 1) All COVID-19 negative pregnancies, 2) All COVID-19 positive pregnancies requiring ventilator support/L3 facility.

Delivery and caesarean were conducted as per existing guidelines and protocols after routine ANC investigations. Babies were handed over to attendants and were isolated from mother till mother continued to be positive. RTPCR of newborns was sent on day 5 after delivery. Repeat RTPCR tests of women were sent at day 10 of their first test. Women were discharged if they were asymptomatic with negative report. They were continued admission on being symptomatic or with positive report. Mothers and babies were followed up via telephonic conversation up to 20 days of discharge.

**Statistical analysis:** In a Microsoft excel spreadsheet, the collected data was entered and evaluated, frequencies were expressed as percentages using tables, barchart and pie diagram to show variables distribution. Data was analysed regarding severity of symptoms, associated comorbidities, mode of delivery, indications of caesarean sections, significant preoperative findings, vertical transmission, neonatal intensive care unit admissions and any other adverse maternal and neonatal outcomes.

**Results**

In our hospital 49 antenatal COVID-19 positive women were admitted. Figure1 shows symptoms among these 49 women. 14 women (28.57%) had mild symptoms (fever, cough, myalgia, anosmia) while 34 women (69.38%) were asymptomatic. One women (2.04%) had moderate severity and required high flow oxygen during C-section (caesarean section) and on 1<sup>st</sup> post operative day, same developed postpartum psychosis on 3<sup>rd</sup> post operative day. None of the women developed serious respiratory symptoms during their course of stay and in follow up.



**Figure 1: Symptoms at presentation**

Among 49 admitted women 6 had co-morbidities (12.24%) ( table 1). Co-morbidities included 1 case each of gestational diabetes, gestational hypertension, preeclampsia and HELLP syndrome (hemolysis, elevated liver enzyme, low platelets). Two women were of intrauterine death with multi-organ failure (1 case required dialysis).

46 women underwent delivery and 2 women (4.08 %)

**Table 1: Maternal comorbidities (n=49)**

GDM	1	2.04%
Gestational HTN	1	2.04%
Preeclampsia	1	2.04%
Sepsis with MOF	2	4.08%
HELLP	1	2.04%
Total	6	12.24%

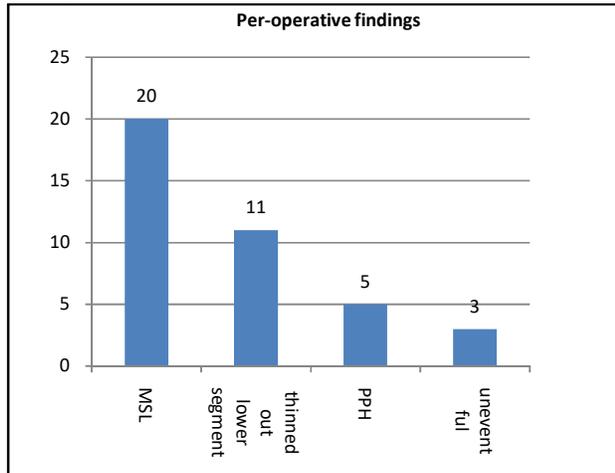
GDM – Gestational diabetes mellitus, HTN – Hypertension, MOF – Multiple organ failure

underwent abortion (one was induced abortion for blighted ovum and other was spontaneous abortion at 10 weeks). 1 with hyperemesis gravidarum (16 week gestation) was conservatively managed. Table 2 shows maternal outcomes.

**Table 2: Maternal outcomes (n=49)**

Modes of delivery (n=46)	Caesarian section	38	82.60%
	Normal vaginal delivery	7	15.21%
	Exploratory laparotomy	1	2.17%
Miscarriage		2	4.08%
ICU admission		2	4.08%
Mortality		1	2.04%

Out of the 46 deliveries conducted 38 (82.60%) underwent C-section, 1 (2.17 %) had exploratory laparotomy and 7 (15.21%) underwent normal delivery including one VBAC (vaginal birth after caesarean) and one induced preterm delivery for IUD (intrauterine death) with MOF (multiple organ failure).



Most important and frequent indication for performing C-section was fetal distress (evident on non stress test) in 25 women (54.34%). 11 women having fetal distress had premature rupture of membranes (PROM) that is 23.9% of total deliveries. Other indications were obstructed labor, CPD (cephalopelvic disproportion), cord prolapse, NPOL (non progress of labor), previous C-section with scar tenderness. Figure 2 shows per-operative findings in C - section/laparotomy of these patients. In per-operative findings 20 women (51.28%) were having meconium stained liquor. While 18 women having meconium were in labor, 2 non laboring women taken up for emergency C-section for fetal distress also had thick meconium. Other important per-operative finding was thinned out lower segment in all 11 women with previous scar though none of them were in advanced labor except the one case operated for previous C-section with ruptured uterus and bladder in 2<sup>nd</sup> stage obstructed labor. Uterine tissue in most of the operated women was edematous, fragile and unhealthy specifically in women of previous scar. 5 women (12.8%) had atonic PPH (post partum haemorrhage) which was medically and surgically managed, only 3 other operated cases had no such significant findings. There were 2 ICU (4.08%) admissions among 49 women due to intrauterine demise with sepsis. One case was 29 week primi gravida with poor general condition having elevated liver function test, deranged

kidney function test with preeclampsia. Induced vaginal delivery was done, subsequently postpartum liver and kidney profile improved. Other was primi gravida with term gestation with IUD and MOF taken for emergency C - section for obstructed labor, patient was shifted to ICU postoperatively. She also underwent dialysis. Recovery period was prolonged with wound gaping and non healing bedsores. Post partum period was uneventful in most of the women however 1 woman reported prolonged anosmia, 1 had postpartum psychosis, in 2 operated cases there was wound gaping. Unfortunately one maternal mortality (2.04%) happened in case of previous C - section with ruptured uterus and bladder however single live baby was rescued by exploratory laparotomy.

**Table 3: Neonatal outcomes (n=46)**

IUD	2	4.34%
Still birth	2	4.34%
Preterm	13	28.26%
IUGR	3	6.52%
NICU admission	3	6.52%
RTPCR test negative after 5 days of live birth	42	100%

IUD – Intrauterine death, IUGR – Intrauterine growth restriction, NICU – Neonatal intensive care unit, RT PCR – Reverse transcription polymerase chain reaction

Amongst 46 delivered, 2 were still born (4.34 %), 2 IUD (4.34%), 13 preterm (28.26%), 3 IUGR (intrauterine growth restriction) (6.52%). 3 (6.52%) neonates required NICU admissions for management (table 3). All neonates had normal Apgar score of 8 to 10, except 3 newborns who had low Apgar score of 3 to 4, they were resuscitated and admitted to NICU and subsequently were discharged in a healthy state. RTPCR tests of delivered babies were sent on day 5<sup>th</sup> of delivery, all babies tested negative for COVID -19.

### Discussion

In our study there were 69.38 % asymptomatic patients and 28.57% having mild symptoms. Only one antenatal patient having moderate symptoms required oxygen support at the time of admission and during C –section, same patient developed post partum psychosis on day 2 of operation rest all post-op patients were maintaining saturation and remained stable.

None of the patients deteriorated during hospital stay or during C - section /delivery. Follow up period was also uneventful indicating that pregnancy as such is not associated with severe consequences in COVID-19 infection. Our findings are similar to WHO joint mission report <sup>11</sup> which investigated 147 pregnant women and suggested that pregnancy does not appear as a risk factor for severe COVID-19 disease, as opposed to pandemic influenza A (H1N1), however report concluded that having COVID-19

during pregnancy may have an impact on fetal outcomes. In a study done by Arun Harishchandra Nayak et al on 144 pregnant women, 97% of women were asymptomatic or had mild symptoms<sup>12</sup>.

Our study suggested that SARS CoV-2 doesn't appear to have increased severity among pregnant women compared to normal population. In our study there was one maternal mortality which was related to obstructed labor with uterine and bladder rupture which in itself is a very high risk case. Study by Pradip Dashraath et al reported that COVID-19 outcomes for the mother appear more promising compared to those of SARS and MERS. Pooled data reveal a case fatality rate of 0%, 18%, and 25% for COVID-19, SARS, and MERS, respectively; in the latter 2 disease syndromes, progressive respiratory failure and severe sepsis were the most frequent<sup>13</sup>.

In our study two ICU admissions can be attributed to multiple organ failure due to sepsis as a consequence of IUD. One patient required dialysis due to acute renal failure. Both women were high risk cases and their course of disease was more related with pregnancy related complications rather than COVID infection. However whether IUD was a consequence of COVID infection is still matter of research.

In our study among 46 deliveries C- section was required in 38 women (82.60%). As per national family health survey rate of C -section in Uttar Pradesh is 18.9%<sup>14</sup> indicating towards higher C- section rate among COVID-19 positive women. We performed C -section for maternal or fetal indications and not due to COVID infection. Studies conducted on COVID positive pregnant women indicate towards higher C section rate among them. In a study by Liu Y et al there were 10 C-section in 13 COVID positive pregnant women<sup>15</sup>. In a meta-analysis by Alvaro Francisco et al 65% women had C section and study by Lina Antouna et al also concluded higher C- section rates in COVID patients<sup>16,17</sup>. Arun Nayak et al concluded that C-section rate were higher in COVID positive women as compared to non COVID but difference was not statistically significant<sup>12</sup>.

COVID pandemic has witnessed an era of tele-medicine, limited ANC visits and minimization of investigations and scans to essential and urgency based. Widespread fear and anxiety among pregnant further prevented them from visiting hospital. These factors may contribute to late detection of high risk women, incomplete workup eventually leading to higher rate of C- section when such women presented at term or in labor. Limited staff and difficulties faced by health care workers in protective gears like PPE kits may be a contributing factor in lowering threshold for C - section in

ANC. Meta-analysis conducted by Jerome Bouaziz et al concluded that only 11 women out of 174 COVID positive pregnancies had normal vaginal delivery rest all underwent C-section<sup>18</sup>. Most common indications for caesarean section were fetal distress and PROM. In our study also most common indication for C-section turned out to be fetal distress and 23.9% women had PROM. Various studies have been conducted showing adverse fetal outcomes related to maternal mental status. In a study by Michael T Kinsella et al fetus of mothers with greater stress reported FHR variability therefore fetal distress may be linked to anxious mental status of COVID positive mothers<sup>19</sup>. However further research is required to assess various factors that may contribute to fetal distress in COVID infection. Study by Berrak Mizrak et al highlighted COVID pandemic has a significant potential for creating anxiety, adversity and fear, which has a negative emotional effect on pregnant people<sup>20</sup>. In our study one of the patient developed postpartum psychosis which may be related to underlying depression due to COVID infection.

In our per-operative findings, 51.28% had meconium stained liquor. In a study by Milind B Kamble on non COVID pregnant patients, out of 8765 deliveries incidence of MSAF was 13.9%, as compared to this meconium in our group is quite high, reason needs further studies in this area<sup>21</sup>. Lower segment was found to be thinned out in all patients with previous scar and there was marked difficulty in suturing uterus because of fragile tissue. This may be attributed to inflammatory response of tissue to COVID-19<sup>22</sup>. More studies are required on evidence of per-operative findings and complications in COVID positive women undergoing C - section for further correlation of our findings.

In our study there were 28.26% preterm deliveries which is more as compared to national rate of preterm births of 13%<sup>23</sup>. This finding correlates with study by Oscar Martinez who found higher rate of PROM, preterm births and more NICU admissions in COVID positive group<sup>24</sup>. Similarly Lina Antouna suggested relatively higher rate of preterm birth, pre-eclampsia in COVID positive ANC<sup>17</sup>. Yangli Liu et al also found increased risk of perinatal complications like fetal distress, PPRM and still birth<sup>15</sup>. Study by David A Schwartz highlighted that MERS and SARS coronavirus had significant adverse clinical outcome including intensive care ventilatory support, IUGR, preterm<sup>9</sup>. Similar outcomes can be expected in COVID also. Systematic review done by Daniele Di Mascio et al quoted that preterm birth is the most common adverse pregnancy outcome in COVID and it was

also associated with higher rate of preeclampsia, caesarean, and perinatal death<sup>25</sup>. We found no evidence of vertical transmission in neonates. Also none developed symptoms in follow up. Huijun Chen et al reported no evidence of vertical transmission in 9 pregnant patients. Similarly Yang Liu et al suggested no evidence of vertical transmission in his study. In a meta-analysis conducted by Alvaro Francisco on 755 pregnant patients only 2% babies were tested positive for COVID with full recovery however author doesn't conclusively label it as vertical transmission. Same results were in study by Lina Antouna on 23 cohort of pregnant patients with no evidence of vertical transmission. Study conducted on 141 patients in India by Arun Harish Chandra Nayak suggested no evidence of vertical transmission<sup>15-17,26</sup>.

Study conducted by Chen et al on amniotic fluid, cord blood and neonatal throat swab samples was negative for SARS CoV-2 in 3 patients<sup>27</sup>. Hence there is no conclusive evidence of vertical transmission in COVID positive mothers and no evidence of neonatal infection. Temporary separation of newborn with mother can be observed to prevent exposure after birth till there are more reports on conclusive routes of transmission.

All patients were negative in repeat RTPCR COVID-19 done on 10<sup>th</sup> day from symptoms onset showing good sero-conversion rate among pregnancy.

#### Conclusion

Our study suggests that COVID-19 infection associated with pregnancy doesn't lead to increased severity or mortality. However there was increased rate of C section, fetal distress, PPRM, meconium stained liquor, preterm delivery. We found no evidence of vertical transmission. Our study is limited by small cohort size and small duration, more research is required in field of pregnancies affected by COVID-19 infection. Our study findings can contribute for further correlation.

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**Conflict of interest:** None. **Disclaimer:** Nil.

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