



**IMPACT OF SECONDWAVE OF COVID19 INFECTION ON PREGNANT WOMEN –AN OBSERVATIONAL STUDY OF DEDICATED COVID HOSPITAL IN CENTRAL INDIA**

**Anupama Dave., Anupama Dave., Pradnya Kapdeo., Kirti Sinha and Priyansha Joshi**

Mahatma Gandhi Memorial Medical College and M.Y. Hospital, M.T.H. Hospital, Indore, Madhya Pradesh, India

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**ABSTRACT**

The second wave of Covid-19 pandemic had drastic effect on pregnant women . Our study aimed to estimate the clinical characteristics, maternal and neonatal outcomes in Covid- 19 positive pregnant women during the second wave of the COVID-19 pandemic. The objective was also to estimate the impact of Covid -19 infection on pregnant women in terms of hospital and pregnancy outcomes. We conducted an Observational study on pregnant Covid positive women admitted for treatment in MTH Dedicated Covid Hospital, Indore, MP, India from 1 April 2021 to 31 May 2021. There were 152 women admitted during this period. Their demographic data, detailed obstetric history, clinical presentation and, investigational findings were studied and detailed analysis was done to study maternal and neonatal outcomes and Hospital outcomes as well.

The incidence of SARS COV2 infection in pregnant women based on admissions in our hospital was 10.4%. The main symptom was fever in 29% of women, 18% were asymptomatic. Significant changes in laboratory parameters & X-ray findings were noted. Maternal outcomes -28.5% of women needed critical care, 39.29% non-invasive ventilation,32.14% had pneumonia on imaging, there were 26 maternal deaths and 123/152 were discharged in a good condition. 5.38% had a pregnancy loss,56.76% were >37 weeks of pregnancy, 40% had a vaginal delivery, 60% had Caesarean section.80 babies were born, 60% were term, 38.75% required nursery admission,4 neonatal deaths, 15% had Neonatal sepsis. Covid positive pregnant women had strong odds of maternal death, ICU admission, need for Oxygen, Preterm birth, stillbirths, and neonatal death compared to Non-covid pregnant women.

Our study concludes that Covid19 positive pregnant and postnatal women suffered morbidity and even mortality in the second wave of the COVID-19 pandemic. This may be related to mutation of the virus and infection with a new variant. However, more studies are required to prove this fact. The impact of Covid 19 infection on pregnant women was tremendous maybe because they were a subset in society who had not been vaccinated. In the future analysis of the effects of the Covid19 infection in pregnant women is important so that we can modify the existing protocols for optimal management.

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**INTRODUCTION**

**Background**

Pneumonia of unknown cause was first identified in Wuhan, China on December 31, 2019 [1] On February 11, 2020, WHO announced it as the new coronavirus disease: COVID-19. This infection spread rapidly across the world and then was declared an International Public Health Emergency. 3 months later on May 7, 2020, there were 3 679 499 confirmed cases and 254 199 deaths in 215 countries.[2] India too was not spared from its effects the first case was reported on 30 January 2020 Till 16th May 2020, the total number of cases in India was 85,940, and 2753 deaths were reported by the Ministry of Health and Family Welfare [3]. The causative

virus was named Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) which is a novel enveloped RNA virus responsible for causing the novel coronavirus disease of 2019 (COVID-19), it causes a multi-system disease ranging in severity from asymptomatic to fatal [4]

Every country is fighting against the most powerful threat of the 21st century that is the COVID-19 pandemic, Worldwide till now 2 notable waves of this infection have been witnessed and now we are in the preparations to fight the third wave. Early data from the UK suggested that pregnant and peripartum women are experiencing more severe illness in the second wave of the COVID-19 pandemic than was observed in the first wave[5]. In India too the second wave proved more fatal than the first with the severity of disease and mortality.

*\*Corresponding author: Anupama Dave*

Mahatma Gandhi Memorial Medical College and M.Y. Hospital, M.T.H. Hospital, Indore, Madhya Pradesh, India

Compared to the general population this wave did have a similar untoward effect on pregnant women as well. Adequate information and understanding of the clinical presentation and impact of the disease on maternal and neonatal outcomes is the key to the successful management of pregnancy with COVID-19.

Because of the changing characteristics of Covid 19 infection, it is important to study its effects on pregnancy and its outcomes, this is the main motive behind our present study. New emergent variants of SARS COV2 could be responsible for the increased morbidities in these women who have not been vaccinated. An analysis of the effects of a mutant strain of the virus on Covid 19 positive pregnant and peripartum women would help in deciding appropriate protocols for management.

**Aims and Objectives**

Our study aimed to estimate the clinical characteristics, maternal and neonatal outcomes in Covid 19 positive pregnant and peripartum women admitted in Maharaja Tukojirao Holkar(MTH) Dedicated Covid Hospital during the second wave of COVID 19 pandemic. The objective was also to estimate the impact of Covid 19 infection on pregnant women in terms of hospital and pregnancy outcomes.

**MATERIAL AND METHOD (STUDY DESIGN AND PARTICIPANTS)**

It was an Observational study on Covid positive pregnant women admitted for treatment in MTH Dedicated Covid Hospital, Indore, MP from 1 April 2021 to 31 May 2021. It was during this period that the second wave of Covid 19 infection was prevalent throughout India which was speculated as being caused mainly by a mutant strain of SARS COV2 - B1.617

The records of 152 Covid 19 positive pregnant women admitted to our hospital during the study period, were examined and analyzed for the course taken by the disease. Babies after birth were seen by a neonatologist and tested for Covid infection within 24 hrs.

Their demographic data, detailed obstetric history, and clinical presentation were noted and studied. All routine and special investigations - covid profile, along with an x-ray chest was done. Diagnosis of the presence of Covid 19 infection was done through Real-time PCR/Rapid antigen test positive status after which they were referred and admitted to our Hospital. The disease was categorized based on clinical and Radiological findings obtained from chest X-ray on admission as per guidelines[6] and then based on severity the recommended appropriate treatment was given according to the Hospital Protocol which was formulated based on various National and International Guidelines (Figure 1)

Investigations done were CBC, LFT, RFT, Lipid Profile, S. Electrolytes, D-Dimer, CRP, LDH, IL-6, PCT ECG. Random blood sugar monitoring was done by a diabetic team and blood sugar control was made with insulin. Radiological findings were interpreted and a COX RADS score[7] was given to decide severity.

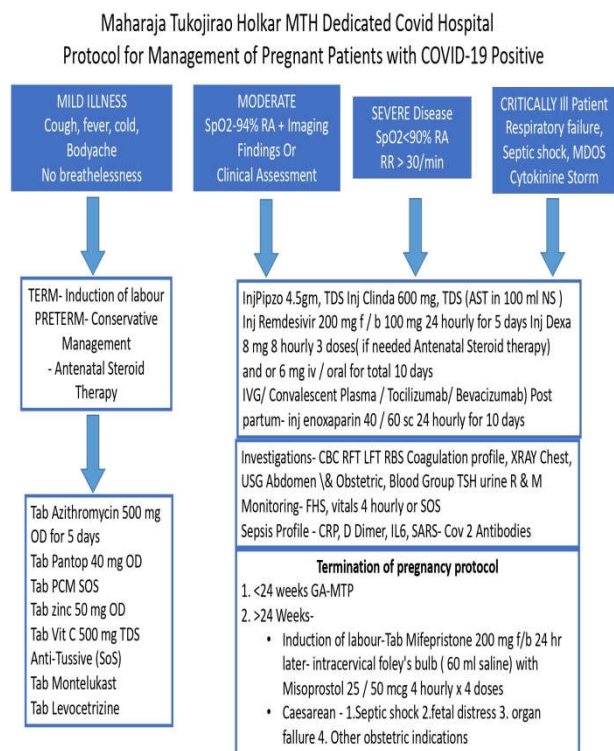


Figure no-1

**Ethical Consideration**

Ethics approval from Mahatma Gandhi Memorial Medical College Ethical Committee was taken (EC/MGM/March4-2/20).All participants signed the informed consent form before recruitment in the study

**Data Collection**

The Data was collected from the Observation checklist, Questionnaire (Semi-structured, Pre-Tested), Patient Discharge cards, and Records. Informed consent of all patients at the time of admission was taken after a detailed explanation regarding prognosis and novel methodology of treatment.

**Statistical Analysis**

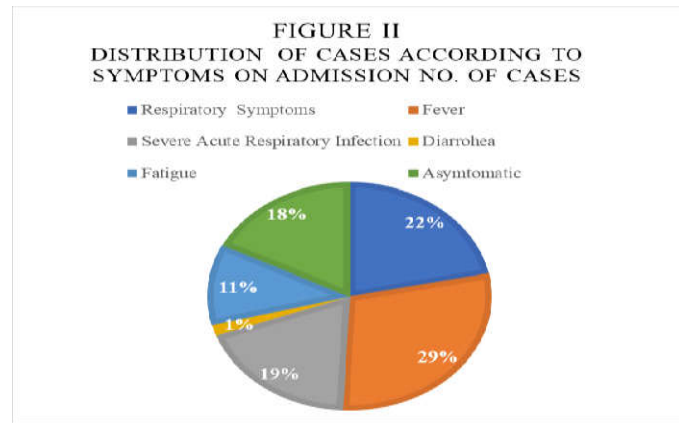
Statistical Analysis was done by SPSS version 25 for Windows. (IBM Corp., Armonk, NY, USA, version 25.0). Variables were summarised using frequency and proportions for categorical data and median (interquartile range (IQR)) or mean ± standard deviation for the continuous variables that were not normally distributed or normally distributed, respectively.

**RESULTS**

MTH Hospital is a Dedicated Covid Hospital attached to MGM Medical College Indore MP. It is 400 bedded and has an ICU of 80 beds which are fully equipped. From its start in April 2020 till 31 May 2021 - 7044 patients have been admitted, out of which 250 pregnant women were managed in our Obstetric wing. The present study was on the second wave of the Pandemic in India which had its peak from 1 April 2021 to 31 May 2021, during this period in MTH Covid Hospital 152 Pregnant women were admitted. In the same period in our Non-Covid Hospital M.Y.Hospital 1454 Non-Covid, pregnant women were admitted, the incidence of Covid 19 infection was estimated to be 10.4%

The demographic characteristics of the women admitted - 48.68% were in the age group of 25-30 yrs, 55.26% had Term pregnancy, 35.52% belonged to lower middle class & 35.52% were educated up to primary school (Table I) On admission, the main symptom was fever in 29% of women, while 18% were asymptomatic (Figure 2) Changes in laboratory parameters included deranged values of CRP in 61.84%, D Dimer in 34.21%, IL6 in 26.97%, LDH in 14.47%, and procalcitonin in 11.84% (Table II)

42/152 (27.63%) had no lung involvement in chest Xray while, 34.21% Grade I, 21.05% Grade II, 11.84% Grade III, and 5.27% Grade IV findings as per COXRADS Scoring on Chest X-ray. (Table III)



Variable	Frequency	Percentage
Age	18-25	32.8
	25-30	48.6
	30-35	18.4
Gestational Age (Wk)	Preterm	42.1
	Term	55.2
Parity	Primi	24.3
	Multi	55.9
Socioeconomic Status	Upper Middle Class	7.8
	Lower Middle Class	35.5
	Upper Lower Class	25
	Lower Class	31.5
Education	High School	24.3
	Middle School	22.3
	Primary Education / Literally	35.5
	Illiterate	17.7
Total	152	100

In Table IV Maternal outcomes showed that 28.5% of women needed critical care, 39.29% non-invasive ventilation, 32.14% had pneumonia on imaging, there were 26 maternal deaths and 123/152 were discharged in a good condition. Data on Pregnancy outcomes revealed 5.38% had a pregnancy loss, majority of women 84/152 (56.76%) were >37 weeks of pregnancy, 40% had a vaginal delivery, 60% Caesarean section in which presence of Covid 19 infection and the maternal compromise was the indication in 35%, 57.69% live births, 4.62% stillbirths

S. No.	Parameters	Number of females with deranged values	
		Number	Percentage
1	CRP	94	61.84
2	D DIMER	52	34.21
3	LDH	22	14.47
4	PCT (Procalcitonin)	18	11.84
5	IL6	41	26.97

S.No.	CO X RADS Scoring		Degree of CXR Involvement	GROUP A	
	Grade	Scoring		Number	Percentage
1	0		No chest involvement	42	27.63
2	I	1-4	Mild chest involvement	52	34.21
3	II	5,6	Moderate chest involvement	32	21.05
4	III	7,8,9	Severe chest involvement	18	11.84
5	IV	10	Severest form	8	5.27
Total				152	100

TABLE IV  
PREGNANCY AND NEONATAL OUTCOME AMONG PREGNANT WOMEN WITH CONFIRMED SARS-COV-2 INFECTION

Pregnancy Outcome	No. Of Women	Percentage
Ongoing Pregnancy	2	1.54
Pregnancy Completed	36	27.69
Pregnancy Loss	7	5.38
Still Birth	6	4.62
Live Birth	75	57.69
Neonatal Death	4	3.08
Total	130	100.00

Gestation At The End Of Pregnancy	No. Of Women	Percentage
<22	10	6.76
22-27	7	4.73
28-31	10	6.76
32-36	37	25.00
>37	84	56.76
Total	148	100.00
Median	>37	

Mode Of Birth	No. Of Women	Percentage
Caesarean Maternal Indication Due To Sars-Cov-2	28	35.00
Caesarean Other Indication	20	25.00
Operative Vaginal	1	1.25
Unassisted Vaginal	31	38.75
Total	80	100.00

Gestational Age	No. Of Women	Percentage
Preterm	32	40
Term	48	60
Total	80	100.00

Perinatal Outcome	No. Of Women	Percentage
Live Birth	74	98.97
Still Birth	6	1.03
Total	80	100.00

COVID Test	No. Of Women	Percentage
Positive	0	0
Negative	80	100
Total	80	100.00

Neonatal Morbidity	No. Of Women	Percentage
Admission to Neonatal Unit	31	38.75
Neonatal Sepsis	12	15
Abnormal Appar	22	27.5
Fetal Distress	18	22.5
Total	83	100.00

Maternal Outcome	No. Of Women	Percentage
Needed Critical Care	96	76.8
Needed Non Invasive Or Invasive Ventilation	122	86.84
SARS-COV-2 Pneumonia Imaging	110	72.3

Final Outcome	No. Of Women	Percentage
Died	26	16.99
Discharged Well	123	81.05
Still in Hospital	3	1.96
Total	152	100.00

Neonatal Outcomes - 80 babies were born, 80/80 tested negative for SARS COV2 RT PCR which was done within 24 hrs of birth. 60% were term, 38.75% required nursery admission, Abnormal Apgar score at birth was seen in 27.5%, fetal distress in the intrapartum period was seen in 22.5% and 15% had Neonatal sepsis.

Comparison with Non-Covid pregnancies (Table V) revealed that Covid positive pregnant women had strong odds of maternal death, ICU admission, need for Oxygen, Preterm birth, stillbirths, and neonatal death.

**TABLE V**  
Comparison of outcomes between COVID and non-COVID pregnant women

Outcome	Comparison Group (non-COVID preg. females)	Pregnant females with COVID	Odds Ratio	95% Confidence Interval	p-value
All cause mortality	17/1454	26/152	17.443	9.1590 to 32.8032	P<0.0001
ICU admission	225/1454	82/152	6.399	4.5127 to 9.0726	P<0.0001
Oxygen through nasal cannula	43/225	118/152	15.122	9.0993 to 25.1505	P<0.0001
ARDS	35/225	16/152	0.639	0.3398 to 1.2005	P=0.1658
Major organ failure	17/225	2/152	0.163	0.0269 to 0.7120	P=0.0168
Chest x-ray changes (grade 1 and above)	56/225	110/152	7.994	4.9568 to 12.6034	P<0.0001
Maternal Outcome					
ICU Admission	225/1454	26/152	1.13	0.7220 to 1.7597	P=0.5983
Preterm Birth (<37 weeks)	68/1454	32/152	5.44	3.4322 to 8.6874	P<0.0001
Cesarean Section	496/1454	48/152	0.89	0.6327 to 1.2762	P=0.5381
Perinatal Outcome					
Stillbirth	83/1185	6/90	1.88	0.4549 to 2.5475	P=0.8668
Neonatal Death	17/1185	4/90	7.63	1.1874 to 11.0126	P=0.0237
Admission to Neonatal Unit	84/1185	31/90	8.28	22.5345 to 83.8438	P<0.0001
Fetal Distress	29/1185	16/90	11.57	6.0948 to 21.9747	P<0.0001

## DISCUSSION

COVID 19 has been associated with untold uncertainty and clinical dilemmas as has been witnessed in the last year. Guidelines for management which are being developed by International agencies and societies are constantly changing. The main reason could be the changing characteristics of the SARS COV2 virus worldwide. A newer mutant strain of the SARS COV2 virus affected humans in the second wave of the ongoing pandemic. In India the speculated strain B.1.167 created havoc and as per a report in Lancet [8] As of May 4, 2021, more than 20.2 million cases of COVID-19 had been reported, with an average of 378 000 cases a day, and more than 222 000 deaths.

The effects on pregnant women were similar to the general population. In our study the incidence was seen to be 10.4%, only positive cases who were referred from other centers were admitted to our hospital. Demographic characteristics of women admitted were comparable to those admitted in Non-Covid hospitals during this period.

The symptoms of severe infection are no different in pregnant women, early identification and assessment followed by prompt supportive treatment are essential. In our study, pregnant women reported symptoms in which predominant was fever in 29 %. In the PRIORITY study in the United States [9] symptoms reported in infected pregnant women were cough (20%), sore throat (16%), myalgia (12%), and fever (12%).

After a positive Covid test, Laboratory tests - the covid profile was done for all women, deranged values of CRP were seen in 61.84%, D Dimer in 34.21%, IL6 in 26.97%, LDH in 14.47% & procalcitonin in 11.84%. In our study majority of women had moderate to severe disease, which was graded based on their clinical findings & Chest X-ray CORADs Score. 34.21% had Grade I, 21.05% Grade II, 11.84% Grade III & 5.27% Grade IV findings. These suggested an increased severity of infection in the majority.

Hospital outcome data revealed that 28.57% pregnant covid19 positive women needed critical care, 39.29% non-invasive ventilation in the form of BIPAP & NRBM, 32.14% had

pneumonia on imaging. There were 26 deaths & 123/152 were discharged in a good condition. Changes in characteristics of the virus made it more virulent and mortalities were seen in women who were admitted with a critical illness.

US data [10] from the first wave of the COVID-19 pandemic in pregnant women (January to June 2020) show that death from COVID-19 during pregnancy was low (0.19%) and similar non-pregnant women of childbearing age (0.25%). A systematic review and meta-analysis of global data from September 2020[11] suggested that pregnancy is a significant risk factor for hospitalization and more severe illness, with a critical care admission odds ratio for pregnant women with COVID-19 compared with infected women of childbearing age of 2.13 (95% CI 1.53–2.95) and an invasive ventilation odds ratio of 2.59 (2.28–2.94).

The latest Intensive Care National Audit & Research Centre report[12] from March 5, 2021, revealed that there was an increase in the number of pregnant or recently pregnant women (ie, within 6 weeks) aged 16–49 years requiring admission to intensive care between the first wave (70 [March 1–Aug 31, 2020]) and second wave (277 [Sept 1, 2020– March 4, 2021])[12]. In their study, it was also seen that since Aug 31, 2020, a greater proportion of pregnant women aged 16–49 years required invasive ventilation within 24 h of admission (87 [14%] of 625 during the first wave vs 31 [8%] of 376 during the second wave).[12].

The need for ventilation and ECMO has been reported in women with severe COVID-19 infection at the time of birth [13] There are reported cases of maternal death too.[14-17] In the second wave in our hospital, suddenly more women were admitted with severe and critical disease and required non-invasive ventilation, invasive ventilation was tried as last resort. We did not have facilities for ECMO. There were a significant number of maternal deaths 26/152.

In data from the UKOSS study[14], 81% of women were hospitalized either in the third trimester or peripartum. The median gestational age was 34 weeks (interquartile range [IQR] 29–38). 59% had cesarean births; 50% were due to maternal or fetal compromise. The remainder were for obstetric reasons or maternal requests (6%). 20% required general anesthesia (GA)

In our study majority of women, 84/152 (56.76%) were >37 wks. of pregnancy, 40% had a vaginal delivery, and 60% Caesarean section in which the presence of Covid 19 infection and a maternal compromise was the indication in 35%, there was pregnancy loss in 5.38% (both spontaneous and induced). All Caesareans were done under Regional Anaesthesia.

Covid 19 being a viral infection there is a concern regarding its transmission to the baby and neonatal outcome. In the UKOSS cohort [14], 27% had preterm births: 47% were iatrogenic for maternal compromise & 15% were iatrogenic for foetal compromise. 10% of term babies required admission to the neonatal unit. 2.5%(6) babies had a positive test for SARS-CoV-2 during the first 12 hours after birth; 3 of these were in babies born by pre-laborcesarean birth. One of these babies required admission to the neonatal unit. There were 2 It was unclear from the report whether two perinatal deaths were related to co-existing maternal COVID-19 In our study 80 babies were born, 60% were term, 38.75% required admission to the neonatal unit, Abnormal Apgar score at birth was seen in

27.5%, fetal distress in the intrapartum period was seen in 22.5% & 15% had Neonatal sepsis. Severe maternal infection was the reason for these unfavorable outcomes.

Earlier studies suggested that the SARS-CoV-2 infection is not transmitted from the mother to child and is not detected in the placenta, amniotic fluid, cord blood, and neonatal throat swab samples [18,19]. But emerging evidence now does suggest that vertical transmission is possible. The evidence of immunoglobulin M (IgM) for SARS-CoV-2 present in neonatal serum at birth was seen in two reports [20,21]. Facchetti *et al.* in their study reported that maternal-fetal transmission of SARS-CoV-2 may be propagated by circulating virus-infected fetal mononuclear cells [22]. Hosieret *et al.* confirmed that SARS-CoV-2 invasion of the placenta does occur, which is predominantly localized to syncytiotrophoblast cells at the maternal-fetal interface [23]. A large systematic review of 666 neonates born to women with confirmed COVID-19 showed that 28/666 (4.2%) neonates had confirmed COVID-19 infection postnatally [24]. In our study, nasal swabs were taken from all babies within 24 hours of delivery to screen for SARS-CoV-2, all (80/80) tested negative.

Our study does show that the presence of Covid 19 infection in pregnancy increased the odds of adverse outcomes both maternal and neonatal when compared with pregnant women without the disease. The odds ratio for maternal death was the highest 17.6, the Odds ratio for the need for oxygen supplementation was 15.12, Preterm birth was 5.44, admission to neonatal unit 8.29, and for neonatal death 7.63. Therefore during the second wave of Covid 19 infection, there was a tremendous impact on the outcomes of the mother as well as the baby, although none of the babies who delivered were positive for SARS COV2 infection after birth.

Our findings were similar to a living systematic review in BMJ[11] in which pregnant women with Covid-19 were compared with pregnant women without the disease, the odds of all-cause mortality was 2.85 (95% CI 1.08 -7.51) & odds ratio of admission to the intensive care unit was 18.58 (95% CI 7.53- 45.82) these were high suggesting an increased risk. Pregnant women with covid-19 were also at a higher risk of preterm birth (odds ratio 1.47) and stillbirth (odds ratio 2.84) and a higher risk of NICU admission (odds ratio 4.89)

## CONCLUSION

Data from our study suggest that majority pregnant and peripartum women had a more severe illness in the second wave of the COVID-19 pandemic. There were similar trends observed in the general population as well. The exact cause of this change is presently unclear but is speculated to be due to mutant strains of the SARS COV 2 virus. To prove this fact more studies are required. The impact of Covid 19 infection in the second wave on pregnant women was tremendous maybe because they were a subset in society who had not been vaccinated till then because of inadequate trials on the safety of the vaccine and its approval for use.

Vaccination of pregnant women has now been included in the protocols of all countries and it has to be seen whether this has an impact and whether it offers protection to them. In the future, analysis of the effects of Covid 19 infection in pregnant women is important so that we can modify the existing protocols for optimal management.

Data supporting findings are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

Ethics approval was got from Mahatma Gandhi Memorial Medical College Ethical Committee prior to the study (EC/MGM/March4-2/20). All participants signed the informed consent form before recruitment in the study.

### Consent for publication

Not applicable

### Competing interests

The authors declare that they have no competing interests.

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