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Original Research Article

Maternal and perinatal morbidity and mortality in COVID-19 positive obstetric patients with medical disorders in tertiary care hospital in North India

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ABSTRACT

Background: Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Most people infected with the COVID-19 virus experienced mild to moderate respiratory illness. Coronavirus is known to human kind since 1930. It was first discovered in domesticated chicken with symptoms of pulmonary infection. The aim and objective was to study clinical profile of patients presented with medical disorders in COVID-19 positive pregnant women.

Methods: Present retrospective COHORT study included 50 COVID-19 positive obstetrics patients. The study was conducted in the department of obstetrics and gynaecology, World college of medical sciences and research, Jhajjar (Haryana). Retrospective review of medical records of all pregnant patients with pre-existing medical disorders or those suspected with medical disorders on the basis of clinical and/or laboratory data from 1 April 2020 through 30 September 2020.

Results: Mean age of the women was 27.46±4.16 years with age range of 20-35 years. Mean period of gestation was 33.26±8.35 weeks. A total of 33 (66%) women were found to be COVID-19 positive due to close contact. 29 (58%) women were found to be asymptomatic and 17 (34%) had various other COVID-19 symptoms. In 17 (34%), sore throat was the commonest symptoms followed by cough, myalgia and fatigue, that is, 13 (26%) each. Fever at the time of admission was present in 9 (18%) women and postpartum fever was observed in 4 (8%) women. Mean hospital stay was 9.24±3.25 days. A total of 29 (58%) women underwent caesarean delivery and 21 (42%) had normal vaginal delivery. Mean postoperative hospital stay was 4.48±2.24 days. In 9 women, postoperative complications were seen. A total of 8 babies admitted to NICU due to various complications. Two babies expired during the study period.

Conclusions: In the present retrospective COHORT study, the majority of the pregnant women with COVID-19 infection had mild symptoms with no severe illness. Mother-to-child transmission of COVID-19 cannot be ruled out. The impacts of COVID-19 infection on patients with medical disorders during pregnancy were seen.

Keywords: Maternal, Perinatal, Morbidity, Mortality, Obstetric, Medical disorders

INTRODUCTION

COVID-19 is an infectious disease caused by a newly discovered coronavirus and a global burden. The disease was first reported in Wuhan city, China in December 2019. It initially considered to be spread by zoonotic transmission with high rate of human to human transmission and rapidly spread to rest of the world and declared as pandemic by WHO on 11 March 2020.¹

As the people are hesitant in seeking treatment for chronic diseases because of pandemic, but obstetrics never stops, as it is a powerful gift of mother nature. The physiological changes of pregnancy are well tolerated by most of women and are reversible.² Medical problems may interfere with the physiologic adaptations of pregnancy and cause poor pregnancy outcome and vice versa.³

Most common medical disorder was pregnancy induced hypertension and its complication seen in 43% of the females, followed by anaemia and hypothyroidism seen in 20% females respectively.⁴

Various type of medical disorders including cardiovascular system, respiratory system, gastrointestinal, renal, endocrine disorders, hematological disorders, central nervous system may exist before pregnancy or may present for first time during pregnancy such as pregnancy induced hypertension and gestational hypertension. The main outcome of pregnancy depends upon the nature of the disease or severity of the disease at the onset of pregnancy and the quality of obstetric and medical management used. Therefore, management of pregnancies with pre-existing medical disorders should begin before conception.

The management of medical disorders in pregnancy based on four important clinical principles. They are medical disorders affected by pregnancy; medical disorders that affect pregnancy; physiological changes may make diagnose of medical disease difficult and treatment of medical diseases may be totally different in pregnant state and non-pregnant state.

Keeping in view the above facts, the present retrospective COHORT study was planned to assess the maternal and perinatal morbidity and mortality in COVID-19 positive obstetric patients with medical disorders. The purpose of this study was to know the consequences of COVID-19 on different medical disorders in pregnancy and their effect on maternal health and foetal well-being and pregnancy affecting medical disorders and their sequel. Further the present retrospective COHORT study determined the clinical course, onset of symptoms to detection of infection, management and outcome of COVID-19 positive obstetric with medical disorders in dedicated COVID-19 hospital. Study tried to understand the interaction of COVID-19 infection with other comorbidity of pregnancy and other life threatening conditions in obstetrics and to track every high risk

pregnancy and outcome of COVID-19 affected high risk patients and problems faced and their on-ground solutions.

METHODS

The present retrospective COHORT study was conducted in the department of obstetrics and gynecology, World college of medical sciences and research, Jhajjar (Haryana). Study reviewed the medical records of all pregnant patients who were admitted to obstetrics and gynaecology department with pre-existing medical disorders or those suspected with medical disorders on the basis of clinical and/or laboratory data from 1 April 2020 through 30 September 2020. All pregnant women admitted with medical disorders from time of diagnosis of COVID-19 positive pregnancy till delivery was included. A total of 50 women were included over a period of 6 months.

COVID-19 was diagnosed by using standard ICMR guidelines for diagnosis and treatment of COVID-19. All COVID-19 patients were diagnosed positive by using reverse transcription polymerase chain reaction results (RT-PCR) from respiratory samples as per the institutional protocol. All required initial investigations were carried out for diagnosis and progress of medical disorders complicated by COVID-19 positive infection.

Methodology

All demographic parameters like chief complaints, past medical and obstetric history of patients were noted in detail. General and systemic examination findings were done and necessary investigations depending upon suspected underlying medical conditions were gathered. Various baseline investigations like complete blood count, peripheral blood smear, liver function test, renal function test, random blood sugar, coagulation profile, viral marker, routine urine and obstetric USG was thoroughly studied in all patients.

Patients were categorized in to three groups by standard MOH guidelines.⁵

Group A

Asymptomatic/patients with mild symptoms with RR: <24 /m and SpO₂: >94% in room air.

Group B

Symptomatic patients with mild to moderate pneumonia with no signs of severe disease with RR: 24-30 /m (or) SpO₂: 90-94% at room air.

Group C

Symptomatic patients with severe pneumonia with RR: >30 /min (or) SpO₂: <90% at room air (or) less than 94% with oxygen, ARDS, septic shock.

Various medical disorders were classified system wise and categorised (Table 1).

All patients received standard medical line of management as per department protocols. Hospitalisation duration and pregnancy outcome noted for those were delivered in our institution. All patients who turned negative for COVID-19 and delivered outside in non-COVID-19 institution, data was collected for same retrospectively.

WHO definitions were used to define patients with anaemia, premature birth, still birth, abortion, primigravida, multipara, maternal mortality and low birth weight. Viral RNA detection using RT-PCR is the standard for the diagnosis. Swab from saliva, nasopharynx, oropharynx, sputum, endotracheal aspirate, bronchoalveolar lavage, urine and stool sample were taken.⁶ As per ICMR, criteria for doing laboratory test are the same for everyone.^{7,8}

Table 1: Various medical disorders were classified system wise and categorised.

Systems	Diseases
Cardiovascular system	Rheumatic heart diseases
	Pregnancy induced hypertension
	Congenital heart diseases
	Dilated cardiomyopathy
Respiratory system	Asthma
	Acute pharyngitis
	Pulmonary tuberculosis
Liver diseases	Acute fatty liver
	Viral hepatitis
	Intra hepatic biliary cirrhosis
	Non-cirrhotic portal hypertension
Renal diseases	Urinary tract infection
	Acute pyelonephritis
	Acute renal failure
Endocrinal disorders	Gestational diabetes mellitus
	Thyroid disorders
Haematological disorders	Anemia
	Idiopathic thrombocytopenic purpura
Protozoal infections	Falciparum malaria
	Vivax malaria
Central nervous system	Cerebrovascular accidents acute non-haemorrhagic infarct
	Seizure disorder
	Acute intraparenchymal bleed
	Tuberculoma
Other bacterial infections	Acute gastroenteritis
	Cholera
Other viral infections	Dengue fever
	Chicken pox
	Measles
Autoimmune diseases	Systemic lupus erythematosus

Asymptomatic pregnant woman tested between 5 and 14 days of coming into direct contact of COVID-19 positive individual. Asymptomatic or detected to be COVID-19 positive during standard screening and referred to our institute for further management. Untraceable report of RT-PCR sample was sent to confirm the diagnosis. Single negative sample of RT-PCR was required to declare the patient as COVID-19 negative. Serology as a diagnostic procedure used only if RT-PCR was unavailable. Samples tested for other viruses, bacterial pneumonia, chlamydia and mycoplasma pneumoniae. Blood cultures taken to rule out secondary infection.⁹ Reinfection suspected as the

patient developed flu like symptoms again and tested with RT-PCR to confirm the diagnosis.

Statistical analysis

Demographic variables that were continuous and normally distributed were expressed as means and standard deviations. Non-parametric continuous variables were expressed as medians with interquartile ranges (IQRs). All data were tested for normality with the appropriate result, presented as median versus mean. Categorical variables were expressed as numbers and percentages. In reporting

outcomes, women are divided into 2 groups: those who were symptomatic and those who were asymptomatic and detected by screening.

RESULTS

In the present retrospective COHORT study, a total of 50 pregnant women included over a period of six months. The demographics of COHORT are presented in Table 2.

Patient characteristics

Maternal age ranged from 20 to 39 years with a mean age (SD) of 27.4±4.16 years with age range of 20-35 years. Mean period of gestation at the time of enrollment in the study was 33.26±8.35. As per routine protocol/as per hospital policy, RT-PCR were conducted for all patients presented in OPD, a total of 33 (66%) were found to be COVID-19 positive due to close contact. A total of 29 (58%) women were found to be asymptomatic and 17 (34%) had various other COVID-19 symptoms. On respiratory examination, a total of 41 women found to be asymptomatic/mild symptoms with RR <24 /m and SpO₂ >94% in room air and 9 women symptomatic with mild to moderate pneumonia (Table 2).

Table 3 shows various COVID-19 symptoms observed in all the women at the time of enrolment in the present retrospective COHORT study. The most common symptom at presentation was sore throat 17 (35%) followed by cough, myalgia and fatigue, that is, 13 (26%) each. Fever at the time of admission was present in 9 (18%) women and postpartum fever was observed in 4 (8%) women. Less commonly reported symptoms included headache (4%), abdominal pain (10%) and chest tightness (8%).

Various medical disorders observed during the study period is shown in Table 4. Most common problem found was PIH, that is, 26 (52%) women suffering from hypertension followed by anemic women 15 (30%).

Different laboratory findings of pregnant women were carried out during the study period which shows mean complete blood count was 10.47±1.26 (range 8.5-13), platelet count 1.90±0.39 per microlitre (range 1.14-2.44), bilirubin 0.71±0.19 mg/dl (range 0.3-1), alkaline phosphatase 217.4±155.83 IU/l (range 34-550), SGOT 57.16±51.50 units/l (range 12-190), SGPT 38.9±31.89 units/l (range 17-120) and random blood sugar was 114.76±38.48 mg/dl (range 72-212).

Table 2: Demographic and medical disorders distribution.

Parameters	Total no. (%)
Mean age (in years)	27.46±4.16 (range 20-35)
Mean period of gestation at diagnosis (in weeks)	33.26±8.35 (range 11-40.4)
Close contact	33 (66)
Health workers	0
Comorbid illness	
GDM	17 (34)
Hypothyroid	12 (24)
IHCP	9 (18)
Preeclampsia	9 (18)
Symptoms	
Asymptomatic	33 (66)
Symptomatic	17 (34)
History of surgery	4 (8)
Respiratory	
Mild	41 (82)
Moderate	9 (18)
Severe	0

Table 3: Patients with symptoms upon presentation.

Parameters	Total no. (%)
Fever at admission	9 (18)
Fever postpartum	4 (8)
Cough	13 (26)
Sore throat	17 (34)
Chest tightness	4 (8)
Hemoptysis	0

Continued.

Parameters	Total no. (%)
Dyspnea	8 (16)
Myalgia	13 (26)
Headache	2
Dizziness	0
Fatigue	13 (26)
Nausea	4 (8)
Vomitting	0
Abdominal pain	5 (10)
Diarrhoea	0

Table 4: Medical disorders in pregnancy.

Parameters	Total no. (%)
Pregnancy induced hypertension	26 (52)
Gestational diabetes mellitus	4 (8)
Epilepsy	1 (2)
Hypothyroid	3 (6)
Cardiac disease	1 (2)
Anaemia	15 (30)
Rh negative	4 (8)
Bronchial asthma	2 (4)
Depression	6 (12)
Cancer	2 (4)
Hepatitis	5 (10)
Inflammatory bowel disease	2 (4)
Sexually transmitted disease	3 (6)
Renal problems	6 (12)

Table 5: Ultrasound examination of pregnant women.

Parameters	Mean±SD (range)
Gestational age (in weeks)	32.9±8.45
BPD	30.83±7.59
AC	32.17±3.30
Fetal length	34.21±2.17
Fetal weight (in kgs)	4.65±8.16
Liquor	11.03±4.39
IUGR	37 (74%)

Table 6: Maternal outcome.

Parameters	Total no. (%)
Hospital stay (in days) mean±SD (range)	9.24±3.25
Mode of delivery	
LSCS	29 (58)
Vaginal	21 (42)
Indications of cesarean section	
Non reassuring fetal heart tones	10 (20)
Repeat caesarean	15 (30)
Arrest of labour	2 (4)
Failure of induction	2 (4)
Postoperative hospital stay (in days) mean±SD (range)	4.48±2.24
Postoperative complications	9 (18)

Table 7: Perinatal outcome.

Parameters	Total no. (%)
NICU stay	8 (16)
Mortality	2 (4)

Ultrasound examination of the women showed that 37 (74%) having intrauterine growth retardation (IUGR). Mean period of gestation was 32.9 ± 8.45 weeks. Mean BPD was 30.83 ± 7.59 , AC 32.17 ± 3.30 , fetal length 34.21 ± 2.17 and fetal weight was 4.65 ± 8.16 kgs (Table 5).

Mean hospital stay of these patients was 9.24 ± 3.25 days.

Delivery characteristics

A total of 29 (58%) women underwent caesarean delivery. Caesarean deliveries were performed for non-reassuring fetal heart tones (N=10), repeat caesarean (N=15), arrest of labour (N=2) and failure of induction (N=2). 21 (42%) had normal vaginal delivery. Mean postoperative hospital stay was 4.48 ± 2.24 days. In 9 cases, postoperative complications were seen.

A total of 8 babies admitted to NICU due to various complications. Two babies expired during the study period.

DISCUSSION

In this retrospective COHORT study, we tried to find out the correlation of COVID-19 positive status in obstetric patients with medical disorders.

Various physiological changes which occurred during the period of pregnancy, make the mother more vulnerable to severe infections.¹⁰ Various anatomical changes like increase in the transverse diameter of the thoracic cage and an elevated level of the diaphragm, decrease maternal tolerance to hypoxia.¹¹ Lung volume changes and vasodilation led to mucosal edema and increased secretions in the upper respiratory tract. Alterations in immune system increased the risk of infection in pregnant women to be infected by various viruses.¹² It was recommended that pregnant women and their newborns should be assessed for various risk factors in the recent COVID-19 pandemic.

In the present retrospective COHORT study, mean age of the women was 27.46 ± 4.16 years. Mean period of gestation was 33.26 ± 8.35 .

Similar to the present study, Breslin et al in their study reported 42 women with maternal age ranging from 20 to 39 years with a mean age 29.7 ± 6.0 years.¹⁴ Median gestational age in their study was 37 weeks.

In maximum number of women, 17 (34%), sore throat was the commonest symptoms followed by cough, myalgia and

fatigue, that is, 13 (26%) each. Fever at the time of admission was present in 9 (18%) women and postpartum fever was observed in 4 (8%) women. A total of 33 (66%) women were found to be asymptomatic and 17 (34%) had various symptoms.

Chen et al conducted a similar study of small sample size in which they included only nine patients with caesarean section in 3rd trimester.¹⁵ They reported seven patients having fever, cough in four patients, myalgia in three patients, sore throat in two and malaise in two patients.

Knight et al prospective study was carried out by using the United Kingdom obstetric surveillance system (UKOSS) also found fever and cough as common symptoms in pregnant women with COVID-19 disease which was found to be similar to the present study.¹⁶

In our study, a total of 29 (58%) women underwent caesarean delivery and 21 (42%) had normal vaginal delivery. A total of 8 babies admitted to NICU due to various complications and two babies expired during the study period. No maternal mortality was seen in the present retrospective COHORT study.

Breslin et al in their study reported 18 women delivered out of which 4 were symptomatic at the time of initial presentation and 14 initially asymptomatic.¹⁴ Of these, 8 women (44.4%) had a caesarean delivery and rest 10 women (55.5%) had normal vaginal deliveries. These findings were found to be almost comparable to the present retrospective COHORT study.

Another study reported by Ayed et al showed 26.6% of neonates preterm and 47.8% of neonates delivered through caesarean section.¹⁷ Similar to caesarean section reported in this study, our study reported 58% women with caesarean delivery.

Smith et al in their systematic review study reported low rates of maternal/neonatal mortality and ICU admissions in pregnant women with COVID-19.¹⁸ However, they further reported that COVID-19-positive pregnant women may be presented with fewer symptoms than the general population. The incidence of PTB, LBW, C-section, NICU admission appeared to be higher as compared to normal pregnant women.

In the present retrospective COHORT study, the most common medical disorder was pregnancy induced hypertension and its complication seen in 48% of the females, hypothyroidism in 22% and anaemia in 16% females.

In 26 (52%) women with pregnancy induced hypertension, perinatal morbidity was seen, 4 (8%) intrauterine death and 12 (24%) IUGR. Maximum number of perinatal morbidity was seen in anaemic women (56% IUGR). Sore throat (34%), cough (26%), myalgia (26%), fatigue (26%), fever (18%) and postpartum fever (8%) were the most prevalent symptoms at the time of enrolment after diagnosis. These symptoms resolved within 4-6 weeks. After 4 weeks, 75% of participants had become asymptomatic and after 5 weeks, 15% more women were asymptomatic. After 6 weeks of treatment, symptoms persisted in 5% of COVID-19 women and rest 5% women no association was established with various symptoms. Average time from symptom onset to complete resolution of symptoms was 42 days.

Breslin et al in their study which was conducted for a 2-week study period included 43 women.¹⁴ Out of these, 20 (69%) reported COVID-19 symptoms as chief complaints and 9 (31%) presented with primary obstetric complaints found to be symptomatic. The most common symptom in their study was dry cough (N=19, 65.6%) followed by fever (N=14, 48.3%) and myalgias (N=11, 37.9%). Headache was found in only 8 women (27.6%), shortness of breath was observed in 7 women (24.1%) and chest pain in 5 women (17.2%). In 29 women, 26 (89.7%) had a combination of all these symptoms.

Due to lack of information about the coronavirus and increasing burden of the disease, it was important that information related to the disease may be shared to the general population in a proper manner. Data with regard to maternal and perinatal outcomes of pregnant women infected with the COVID-19 was found to be limited in the literature.

Limitation of the present retrospective COHORT study was small sample size with shorter duration. So, further studies with large sample size and duration are required to evaluate long-term maternal and perinatal outcomes in pregnant women.

CONCLUSION

Various types of medical disorders in obstetric patients are multifactorial and affects maternal and foetal outcome. If these symptoms detected at early stage, treatment protocol may be very easy and very few side effects may be observed to the mother and foetus. All these conditions suggests regular follow up, early detection of medical disorders, immediate action regarding treatment, regular follow up and to educate the women and aware them about these medical disorders and available treatment in time to improve maternal and foetal outcome.

In the present retrospective COHORT study, the majority of the pregnant women with COVID-19 infection had mild symptoms with no severe illness, but severe maternal and perinatal morbidity requires admission to intensive care unit.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. WHO. Fact sheet: Coronavirus disease (COVID-19) Pandemic, 2020. Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>. Accessed on 10 June 2021.
2. Burrow G, Duffy T, Copel JA. Obstetric management of the high-risk patient. Medical complications during pregnancy. 6th ed. WB Saunders; 2004: 1-12.
3. Milind CA, Girish PB, Tushar TC, Abhijeet MC, Shashank TC, Hemant NC. A clinical study of medical disorders in pregnancy. *Nat J Med Dent Res.* 2016;4:257-63.
4. Shriastava S, Malik N. Medical disorders in pregnancy and pregnancy outcome a retrospective analysis. *Int J Reprod Contracept Obstet Gynaecol.* 2018;7(6).
5. Clinical management. Available at: <https://www.mohfw.gov.in/pdf/ClinicalManagementProtocolforCOVID19dated27062020.pdf>.
6. ICMR-National Institute for Research in Reproductive Health. Fact sheet: Guidance for Management of Pregnant Women in COVID-19 Pandemic, 2020. Available at: <http://www.nirrh.res.in/wp-content/uploads/2020/04/Guidance-for-Management-of-Pregnant-Women-in-COVID-19-Pandemic.pdf>. Accessed on 10 June 2021.
7. ICMR. Fact sheet: COVID-19 testing, 2020. Available at: [documents/2020-03-20covid19testv3.pdf](https://www.who.int/docs/default-source/coronavirus/202003-20covid19testv3.pdf)
8. Good clinical practice recommendation on pregnancy with COVID-19 infection. FOGSI, 2020. Available at: https://www.fogsi.org/wp-content/uploads/covid19/fogsi_gcpr_on_pregnancy_with_COVID_19version1.pdf. Accessed on 10 June 2021.
9. Liang H, Acharya G. Novel corona virus disease (COVID-19) in pregnancy: what clinical recommendations to follow? *Acta Obstet Gynecol Scand.* 2020;99(4):439-42.
10. Goodnight WH, Soper DE. Pneumonia in pregnancy. *Crit Care Med.* 2005;33(10):390-7.
11. O'Day MP. Cardio-respiratory physiological adaptation of pregnancy. *Semin Perinatol* 1997;21(4):268-75.
12. Nelson-Piercy C. Respiratory disease. *Handbook of Obstetric Medicine.* Boca Raton: CRC Press; 2015: 371.
13. Chawla D, Chirla D, Dalwai S, Deorari AK, Ganatra A, Gandhi A, et al. Perinatal-neonatal management of COVID-19 infection-guidelines of the federation of obstetric and gynaecological societies of India (FOGSI), National neonatology forum of India

- (NNF), and Indian academy of pediatrics (IAP). *Indian Pediatr.* 2020;57(6):536-48.
14. Breslin N, Baptiste C, Gyamfi-Bannerman C, Miller R, Martinez R, Bernstein K, et al. Coronavirus disease 2019 among asymptomatic and symptomatic pregnant women: two weeks of confirmed presentations to an affiliated pair of New York City hospitals. *Am J Obstet Gynecol MFM.* 2020;2(2):100118.
 15. Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *Lancet.* 2020;395(10226):809-15.
 16. Knight M, Bunch K, Vousden N, Morris E, Simpson N, Gale C, et al. Characteristics and outcomes of pregnant women admitted to hospital with confirmed SARS-CoV-2 infection in UK: national population based COHORT study. *Br Med J.* 2020;369:2107.
 17. Ayed A, Embaireeg A, Benawadh A, Al-Fouzan W, Hammoud M, Al-Hathal M, et al. Maternal and perinatal characteristics and outcomes of pregnancies complicated with COVID-19 in Kuwait. *BMC Pregnant Childbirth.* 2020;20:754.
 18. Smith V, Seo D, Warty R, Payne O, Salih M, Chin KL, et al. Maternal and neonatal outcomes associated with COVID-19 infection: a systematic review. *PLoS One.* 2020;15(6):0234187.

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