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Cardiovascular *Case Report*

COVID-19 Pregnancies with Heart Disease: Challenges of Delivery

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ABSTRACT

This case series of four cases of pregnancy with rheumatic heart disease with COVD-19 disease reports on the management of delivery and complications of heart disease with COVID-19, high-lighting the presentation, severity, delivery concerns, and clinical management with the maternal and fetal outcomes. Of the four full-term deliveries, one delivered normally, one instrumental delivery and two by cesarean section. All four required oxygen support post-delivery, 2/4 (50%) were transferred for intensive care unit (ICU) care, 1/4 (25%) required mechanical ventilation, 1/4 (25%) had postpartum hemorrhage, 1/4 (25%) had COVID related sepsis and received convalescent plasma therapy, and 2/4 (50%) received antiviral remdesivir. The most severe disease (COVID sepsis and ICU stay) was seen in patient of heart disease with COVID with preclampsia. All neonates tested SARS-CoV-2 negative, with one early neonatal death. All four mothers were discharged in stable condition of COVID and heart status. COVID-19 in cardiac disease pregnancies has increased rates of complications, oxygen, and ICU requirements than other pregnancies with COVID, requiring multidisciplinary team for intensive monitoring of intrapartum and postpartum period.

Keywords: Cardiac disease, Delivery, Pregnancy, COVID-19

INTRODUCTION

The unprecedent pandemic of SARS-CoV-2, since December 2019, affected pregnant and postpartum women adversely. They are poised at higher risk of COVID-19 outcomes, as seen with other viruses (H1N1, SARS, and MERS) of the respiratory tract.[1] The risk of acquiring the novel coronavirus in pregnancy is similar to non-pregnant females. Asymptomatic or mild disease occurs in majority but the symptomatic ones are at a higher risk of landing in severe disease. Studies earlier in the pandemic painted an optimistic picture for the outcomes of pregnancies with SARS-CoV-2 infection where mortality rates are very low.[2] A living systematic review and meta-analysis has reported that although pregnant women with COVID-19 as compared to non-pregnant counterparts have reported lesser symptoms of fever and myalgia, pregnant women are more likely to require admission to intensive care unit (ICU) and ventilation more often. Severity of COVID-19 in pregnancy is further increased with advanced maternal age, high body mass index, chronic hypertension, and pre-existing diabetes.[1]

There is generally good fetal outcome with no increase in spontaneous abortion or intrauterine fetal deaths except in those pregnancies with very severe COVID. Pre-term birth rates are high in pregnant women with COVID-19 than in pregnant women without the disease.[1]

Heart disease in pregnancy is high-risk conditions due to hemodynamic overload of pregnancy on the cardiovascular system added with the SARS-CoV-2 infection, deterioration of cardiac function is imminent.[3] SARS-CoV-2 affects the respiratory, cardiac, and coagulation systems which have already been physiologically adapted to bear the pregnancy load. Hence, pregnant women having heart disease and SARS-CoV-2 infection can have a greatly increased maternal morbidity and mortality due to the overlapping of complications. The evidence of acute respiratory distress syndrome caused by COVID-19 causing 12.5% maternal deaths having a high prevalence of heart disease as a comorbidity has been reported by Brazilian Ministry of Health.[4]

A heart disease unrecognized before pregnancy diagnosis is most likely to be missed as the presenting symptoms of heart diseases and COVID-19 such as shortness of breath, cough, and fatigue being common can confuse clinicians. Rheumatic heart disease is still the most common cause of heart disease in pregnancy in India when compared to developed nations where congenital heart disease is now more common. Maternal mortality for women with severe and moderate mitral stenosis was found to be 3% and 1% respectively, in the medium to higher Human Development Index countries, so the rates in developing countries are assumed to be much higher due to lack of early recognition and facilities.[5]

However, the clinical outcomes of COVID-19 in pregnancy with heart disease are still under-reported, management difficult, and prognosis uncertain. Paucity of available reported outcomes of pregnancy in patients with heart disease and COVID-19 was found when a literature search was made for such cases. This case series reports on the management of delivery and complications in pregnancies of heart disease with COVID-19, high-lighting the presentation, severity, delivery concerns, and clinical management with the maternal and fetal outcomes.

CASE DETAILS

Out of 54 COVID-positive pregnancies delivered in a dedicated multispecialty COVID hospital from July to November 2020, four cases (7.4%) were of heart disease in pregnancy. All cases were confirmed SARS-CoV-2 tested on nasal and oropharyngeal swabs by the reverse transcription–polymerase chain reaction method. Out of the four cases of COVID-19 infection in cardiac disease, two were in the WHO Risk Class III (One Moderate MS and one Post-mitral Valve Replacement) and two in the WHO Risk Class IV (severe mitral stenosis). A multidisciplinary team of obstetricians, cardiologist, anesthesiologists, intensive care specialist and nursing teams of labor room, operation theater, and ICU were involved in care.

Case 1

A 22 years primigravida COVID-19-positive reported in second stage of labor at 40 weeks of gestation with pre-eclampsia (BP 170/110 mm Hg and urine protein 3+ on admission), anemia (Hb 7 g%), mitral stenosis (1.5 mitral valve area, moderate MS, LEVF 60% mild AR dilated LA, and mild pericardial effusion on admission echo), hematuria, and heart failure with decreased oxygen saturation. Initially oxygen, frusemide, and labetalol injections were given and outlet obstetric forceps applied to deliver a 2.680 Kg distressed baby. She had atonic postpartum hemorrhage (700 ml), could be managed with uterotonics and guarded crystalloids as she was in heart failure. She was a NYHA Class II in pregnancy, and deteriorated to NYHA IV after COVID-19 infection (m WHO III). Post-delivery anticoagulation with low molecular weight heparin (LMWH), antibiotics, and diuretics was initiated and transferred to ICU for respiratory failure. Forty-eight h intermittent non-invasive ventilation was required and oxygen requirement was for 5–12 days of hospital stay. She was discharged in good condition with conversion of LMWH to warfarin and Hb of 10.9 after 2 units packed blood cell transfusion.

Case 2

A second gravida 28 years post-cesarean pregnancy diagnosed with rheumatic mitral stenosis (critical MS with Mitral Valve Area 0.9 and Ejection Fraction 60%) 7 years ago NYHA II (m WHO II-III) on beta-blockers and digitalis and not in failure, maintaining oxygen saturation on room air. She was delivered by emergency cesarean section at 39 completed weeks for prolonged deceleration on electronic fetal monitoring. She was an asymptomatic COVID-19 and was antenatally but required oxygen supplementation by mask for 48 h post-delivery. The 2.7 kg male baby had meconium aspiration syndrome at time of cesarean, was admitted to NICU, later developed Hypoxic Ischemic Encephalopathy and disseminated intravascular coagulation, and died on day 4 of life. Patient was discharged after 8 days stay in hospital.

Case 3

A 22-year-old primigravida had a mitral valve replacement 5 years ago on warfarin, digoxin, penicillin, and frusemide and was delivered under epidural labor analgesia at 38 weeks. Patient went into spontaneous labor after blood transfusion for severe anemia (hemoglobin 5.5 g/dl) and normal vaginal delivery of a growth restricted baby of 2.165 kg with normal APGAR. She was NYHA Class 1 (m WHO IV) at admission but post-delivery required oxygen supplementation for maintaining oxygen saturation >94% for 1 day. She was transfused a total of 4 units of blood, before and after delivery. Mother was transitioned from LMWH to warfarin and with baby was discharged in stable condition on day 9.

Case 4

A 26-year-old post-cesarean second gravida was having proper antenatal care at a different hospital with NYHA Class II m WHO III (19–27%) came with labor pains. She was taken for cesarean section under spinal anesthesia and had no intra or post-operative morbidity. The mother and baby of 2.7 kg birth weight were discharged after 11 day of hospital stay.

Four cases were delivered, all at full-term gestations, one had normal delivery, one as instrumental, and two as cesarean sections. All were given regional analgesia for labor and combined spinal and epidural anesthesia by expert anesthetic team. Hospital stays ranged from 8 to 12 days for all deliveries for stabilization [Table 1].

In these four cases of COVID-19 pregnancies with heart disease, 75% required oxygen support for maintaining saturation through face mask before delivery and 100% required it post-delivery. About 50% were transferred for ICU care but none required mechanical ventilation. One had an episode of postpartum hemorrhage managed by uterotonics and blood transfusion 2 units. Case 3 was transfused blood for severe anemia but did not increase the severity of COVID. One out of four (25%) had COVID related sepsis, one received convalescent plasma therapy, 50% received antiviral remdesivir injections as per protocol for moderate-to-severe COVID [Table 2].

The most severe disease (COVID sepsis and ICU stay) was seen in patient of heart disease with COVID (Case 1) and pre-eclampsia resulted in deterioration of cardiac functional status from NYHA II to IV although pre-delivery was at the WHO Risk Class II with only a small increased risk of maternal mortality or moderate increase in morbidity as per her cardiac lesion.

All newborns were isolated and cared for in neonatal intensive care as per institutional protocol. One neonatal death occurred due to Meconium Aspiration Syndrome and sepsis although the baby tested SARS-CoV-2 negative. There were no maternal deaths and all four mothers were discharged in stable condition of COVID and heart status.

DISCUSSION

In India, rheumatic heart disease is the main etiology of heart diseases encountered during pregnancy, followed by congenital heart diseases and cardiomyopathies.[6] The total prevalence of heart disease in pregnant women is 0.2–4%, half of which have a congenital anomaly in developed

Table 1: Maternal and neonatal clinical details.

	Case 1	Case 2	Case 3	Case 4
Age (years)	20	28	22	26
Heart lesion	Moderate Mitral stenosis	Critical mitral stenosis	Mitral Valve replacement For critical mitral stenosis	Severe mitral stenosis
NYHA*	NYHA Class II to NYHA IV in COVID-19 infection	NYHA II	NYHA Class1	NYHA Class II
m WHO cardiac status**	m WHO II (10–19%)	m WHO III (19–27%)	m WHO III (19–27%)	m WHO III (19–27%)
Antenatal care	Suboptimal	Suboptimal	Yes	Yes
Gestational age at delivery (completed weeks)	38	39	38	37
PREECLAMPSIA	Yes	No	No	No
Mode of delivery	Instrumental (Outlet obstetric forceps)	LSCS (fetal distress in the previous CS)	Normal Delivery	LSCS (elective in the previous CS)
Analgesia	Labor analgesia	Spinal+epidural	Labor (epidural) analgesia	Spinal+epidural
Post-Partum Hemorrhage	Yes	No	No	No
Blood Transfusion	Yes (2 units)	No	Yes (4 units)	No
Baby details	2.68 kg Discharged	2.8 MAS#, HIE##, DIC ###in NICU#### Neonatal death D4	2.165 kg Discharged	2.7 kg Discharged
Stay in hospital (days)	12	8	9	11 days

*NYHA: N*ew York Heart Association (NYHA) Classification,* **mWHO cardiac status: Modified World Health Organization (WHO) Classification of Maternal Cardiovascular Risk, #Meconium aspiration syndrome (MAS), ## Hypoxemic Ischemic Encephalopathy, ###Disseminated intravascular coagulation, ####Neonatal Intensive Care Unit

Table 2: Laboratory parameters and severity of COVID.

	Case 1	Case 2	Case 3	Case 4	% affected/ elevated
Anemia (Hemoglobin<11 g/dl)	Yes (8.4)	No (10.5)	Yes (5.4)	Yes (9.2)	75 anemic
Total Leukocyte Counts/mm^3	20,000	11,300	10,160	6,950	25
Platelets×10^9/L	312	128	140	164	
C-reactive Protein (0–5 mg/L)	14.8	2.8	12.11	2.21	50
Ferritin (10–291 ng/ml)	19.92	44.4	78.9	52.2	
Lactate Dehydrogenase (230–460 IU/L)	672.48	387.6	760.7	654	75
Procalcitonin (<0.05 ng/mL)	0.39	0.40	0.84	0.14	100
D DIMER (<0.4 mcg/mL)	3.74	2.29	5.6	2.83	100
Oxygen requirement at admission (L/min)	15	No	Yes (@3L for 3 days)	Yes	75
Oxygen requirement post-delivery (L/min)	22	Yes (5l for 2 days)	Yes (5l for 2 days)	Yes (10l for 3 days)	100
Intensive Care Unit care	Yes (6 days)	No	No	Yes (2 days)	50
COVID sepsis	Yes	No	No	No	25

countries. About 56–89% are of rheumatic origin in the developing countries.[7]

Prompt testing for SARS-CoV-2 and isolation should be done upon any new onset cough or anosmia in pregnant women with cardiac disease. Diagnosed positive cases require a multidisciplinary team of obstetricians, intensivists, obstetric anesthetists, microbiologists, and neonatologists at a higher center of care.[4] The prognostic factors in cardiac disease are the pre-pregnancy functional status, ventricular ejection fraction, type and severity of cardiac lesions, and any previous adverse cardiac events.

A review comprising 80,000 COVID-19 pregnant women have reported lesser presentation by fever (OR 0.43) and myalgia (OR 0.48) but increased risk of requiring ICU admission (OR 1.62) and invasive ventilation (OR 1.88). Severe disease occurred more in elderly pregnancy, obesity, pre-existing hypertension, and diabetes.[1] Cardiac disease in pregnancy was not addressed in this meta-analysis. Even CDC does not include valvular heart disease as a comorbidity that act as risk factor for severe COVID-19.[8]

Asymptomatic pregnancies with heart disease testing positive for SARS-CoV-2 should be mandatorily given hospital or telemedicine care in early pregnancy for monitoring of symptoms and worsening parameters. Life-threatening medical emergencies such as heart failure can occur anytime pregnant women affected with cardiac disease, especially during 28–32 weeks and labor delivery.

Conflicting results of ICU admission (7%) in symptomatic COVID pregnant women with no 3–4% intubation rates have been cited.[9,10] In this series, 50% of COVID pregnancies with heart disease required ICU care and 25% of mechanical ventilation (non-invasive) whereas among other than heart disease 6/50 (12%) required ICU admission.

Thirteen out of 50 deliveries in COVID-19-positive deliveries were pre-term (26%) in our center but none in this heart disease group. The increased risk of pre-term births in most COVID pregnancies was not found in this cohort.[11] Another study from India has reported 3 times higher pre-term delivery in women with HD and COVID-19 (95% CI 0.33–20.48), along with higher rates (14 times) of pre-labor rupture of membranes.[12]

For most cardiac patients, vaginal route is preferred for delivery and cesarean section reserved for obstetric indications as greater blood loss, increased thromboembolism, and infections risk for mother. Elective cesarean section is indicated for those on oral anticoagulants (because of risk of fetal intracranial bleeding), Marfan syndrome with ascending aorta diameter >45 mm, acute or chronic dissection, and acute heart failure.[13] In critically ill antenatal mothers (with hypoxia, cardiovascular or neurological complications, or signs of progressive multiple organ failure), a cesarean section is the most appropriate route of birth.

Although urgent cesarean delivery is suggested for gravidas with advanced heart failure and hemodynamic instability despite treatment, the first patient of this case series who had heart failure and impending eclampsia was delivered by vaginal instrumental delivery as she was referred in the second stage of labor. Maternal vitals monitoring in labor for systemic arterial pressure and heart rate is mandatory. Pulse oximetry becomes important in care of laboring COVID parturient for detecting any fall in oxygen saturation. Electrocardiogram use is as indicated by the patient's condition. Avoiding supine position in labor with a left lateral tilts and attend to any hemodynamic fluctuations occurring with uterine contractions. Continuous electronic fetal heart rate monitoring is recommended during labor. Descent of

the fetal head to the perineum should be allowed with uterine contractions so that the circulatory overload due to maternal pushing is avoided. Low forceps or vacuum extraction can then be used to assist the delivery of head.

The hypercoagulable state of pregnancy increases the risk of thromboembolism in women with heart disease. The combination of COVID-19 and mechanical valve prosthesis or atrial fibrillation in rheumatic valve disease increases the risk of thromboembolic events in pregnant women. For postpartum women having heart disease and COVID-19 both, thromboembolism is a serious threat. All patients in this case series received thromboprophylaxis with LMWH which was continued till 6-week postpartum. They were also advised meticulous leg care, compression stockings and were allowed early ambulation for reduction of puerperal thromboembolic risks.[13]

Antibiotic prophylaxis is a routine practice for all cesarean sections for reducing the risk of postpartum endometritis. In addition, endocarditis protection is also ensured.

Cardiomyopathy has been reported in pregnant COVID patients, but it is not known whether COVID-19 cardiomyopathy is exacerbated in pregnancy or not.[14]

Pregnant women with MS are at risk for pulmonary edema and atrial arrhythmias. Hemodynamic changes in pregnancy cause an increase in the gradient across the stenotic mitral valve and could lead to pulmonary congestion. Even when pregnancy is not complicated by the development of pulmonary edema, some women with MS experience deterioration in their functional class or develop new cardiac symptoms. Moreover, COVID can be one of the factors for this as seen in this series of cases.

Monitoring post-delivery should be in a special care unit, such as an intensive care and coronary care where cardiac complications can be promptly diagnosed and treated. Monitoring should be for 24 h, as post-delivery fluid shifts may extend beyond delivery duration, if regional anesthesia was used.

The laboratory parameters studied in COVID for these pregnant women were ferritin, total leukocyte count (TLC), C-reactive protien (CRP), lactate dehydrogenase (LDH), D-dimer, and procalcitonin as they are related used for predicting COVID-19 infection severity. The recommended cutoffs for ferritin are 109.8 ng/mL, WBC is 14.9109/L, CRP 10.15 is mg/L, and LDH is 229.33 U/L as per a study in China.[15,16] In this case series, only higher TLC predicted a COVID sepsis but other parameters were similar among all four cases but had severedisease.

The core members for managing these cases were cardiologist and the gynecologist, anesthetist, and neonatologist. Care of high-risk patients requires a team approach including a maternal-fetal medicine specialist, cardiologist, and obstetrical anesthesiologist. European Society of Cardiology guidelines for the management of grown-up congenital heart disease are modified for pregnant women with heart disease according to disease complexity and pregnancy risk.[16] Level 1 represents care for highly complex and high-risk (WHO Class III or IV) lesions, for which exclusive care in a specialist unit is advisable, usually monthly or bimonthly. During pregnancy, standard cardiac follow-up for most women will consist of clinical assessment and echocardiography.

Pregnancy in a cardiac disease is a complex population of patients requiring protection from SARSCoV-2 and a proactive, tailored treatment in case of COVID-19 infection. All medical organizations recommend for COVID-19 vaccination in the unvaccinated pregnant or recently pregnant or those planning pregnancy, as reduction of risk of COVID-19 and disease severity occurs which will better the maternal outcomes in cardiac patients as well.

CONCLUSION

COVID-19 in pregnant women with cardiac disease has increased rates of complications, oxygen requirements, and ICU requirements than other COVID pregnancy patients. They require hospitalization, intensive monitoring and protocol-based treatment, and delivery for a good maternal and fetal outcome in COVID-19 with cardiac disease in pregnancy.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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