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Anaesthetic Management of a COVID Positive Pregnant Patient with Large Atrial Septal Defect Undergoing Caesarean Section - A Case Report

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Abstract

Introduction: The Corona Virus Disease 2019 (COVID-19) is a multi-systemic disease which primarily affects the respiratory system but also causes significant damage to the cardiovascular system. There is limited research at present on the effect of this virus on patients having congenital heart disease.

Case Report: We report the case of a COVID-positive term pregnant patient having a 3 cm Ostium Secundum-Atrial Septal Defect (OS-ASD) with left-to-right shunt who underwent an emergency lower segment caesarean section (LSCS). She was at a high risk of paradoxical embolism due to the hypercoagulable state of pregnancy and COVID-19 associated coagulopathy. Her LSCS was performed under spinal anaesthesia in the designated COVID operation theatre with due precautions taken to prevent spread of infection. Intraoperatively, we avoided factors that can increase left-to-right shunt or cause shunt reversal. Care was taken to prevent paradoxical air embolism.

Conclusion: In the setting of the COVID-19 pandemic, our main learning points were understanding the implications of COVID-19 on the perioperative management of a pregnancy complicated by a large ASD with left-to-right shunt and prevention of the dreaded paradoxical embolism.

Keywords: COVID-19, atrial septal defect, ASD, pregnancy, paradoxical embolism

Introduction

Since its first reporting in Wuhan, China in December 2019, Corona Virus Disease 2019 (COVID-19), caused by the SARS-CoV-2 virus has infected and killed millions globally. The virus predominantly attacks the respiratory system but has several other systemic effects, both short and long-term [1]. The entry of the virus is mediated via binding to the Angiotensin Converting Enzyme-2 Receptor (ACE-2) which is expressed in airway epithelial cells, vascular endothelial cells, immune cells, heart and intestine. This leads to the multi-system involvement seen in COVID-19. The virus causes direct myocardial injury and myocarditis as well as indirect cardiac injury secondary to the hyperinflammatory immune response and cytokine storm [1]. This multi-systemic immune response and cytokine storm is responsible for COVID-19 associated coagulopathy. It is characterised by coagulation abnormalities like increase in fibrinogen and D-dimers and has been associated with thromboembolic complications and higher mortality [2]. Immunologic adaptations of pregnancy leads to hypercoagulability, which may increase the risk of severe COVID-19 disease and morbidity [3].

Patients with congenital heart disease (CHD) such as atrial septal defects (ASD) could be considered at higher risk for complications from COVID-19 depending on the disease severity and the patient's functional reserve [1]. Paradoxical embolism having an incidence of 14% among ASD patients, increases the risk of strokes perioperatively [4]. In the setting of pregnancy, a hypercoagulable state and COVID-19 associated coagulopathy, the risk increases manifold. There is a paucity of data at present on the effect of COVID-19 on patients having congenital heart disease and its implications in the perioperative period. At present, anaesthetic management strategies are extrapolated from available data on the effect of COVID-19 on healthy adults and those with cardiovascular disease.

In this case report, we describe the anaesthetic management of the emergency Caesarean section of a term pregnant patient with a 3cm ASD with a left-to-right shunt having mild COVID-19 disease.

Case Report

We report the case of a 20-year-old COVID-19 positive primigravida at 38+ weeks of gestation with a large ASD measuring 3 cm who came to our hospital for an emergency Lower Segment Caesarean Section (LSCS) in view of foetal distress. The patient reported gradually increasing breathlessness since the onset of an otherwise uneventful pregnancy. At the time of presentation, she was having breathlessness during ordinary physical activity but was asymptomatic at rest (WHO Class II, NYHA Class II). There was no history of any features suggestive of pulmonary hypertension or cardiac failure. On auscultation, there was a wide fixed splitting of S2 and an ejection

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systolic murmur was heard at the pulmonic area and therefore the opinion of a Cardiologist was sought. ECG showed right axis deviation, right bundle branch block and right ventricular hypertrophy. 2D Echocardiography revealed a large Ostium Secundum (OS) ASD of 3 cm with a left to right shunt. She was also having sore throat and dry cough and a COVID RTPCR test was done which came positive. She was maintaining normal oxygen saturation on room air and her chest X ray was normal. Coagulation profile was normal apart from her D-dimer which was elevated (585 ng/ml).

We took written and informed consent from the patient after duly explaining the risk of thrombosis due to COVID-19 disease and the hypercoagulable state of pregnancy, paradoxical embolism, shunt reversal and Eisenmenger syndrome, heart failure, postpartum haemorrhage, blood loss, blood transfusion and post-operative mechanical ventilation. Since this was an emergency LSCS, the mother was not adequately fasting and was given aspiration prophylaxis with ranitidine 150 mg IV and metoclopramide 10 mg IV 30 minutes before the surgery.

We conducted the case in the designated COVID operation theatre (OT) in our hospital. ASA standard monitoring was instituted and wide-bore IV access was secured. To prevent aortocaval compression by the gravid uterus, a left lateral tilt was given. Care was taken to prevent the entry of air through the IV access site as it can lead to a paradoxical air embolism. Nasal prongs were put on the nostrils of the patient and oxygen was given at 6l/min. Deep Vein Thrombosis (DVT) pumps were applied to prevent venous stasis. Following aseptic precautions, spinal anaesthesia was administered with 2 ml of 0.5% heavy bupivacaine after confirmation of free flow of CSF. We started phenylephrine infusion at 25 mcg/min and titrated it to maintain normotension after administering spinal anaesthesia. The baby was born healthy and cried immediately after birth. Following delivery of the baby and clamping of the cord, prophylactic oxytocin infusion was administered for prevention of postpartum haemorrhage. Phenylephrine infusion was discontinued just before completion of the surgery. The patient was shifted to the post anaesthesia care unit designated for COVID-19 patients after completion of the surgery.

Discussion

The intricate complexity of COVID-19 disease superimposed on a pregnancy with a large 3 cm ASD in this case, posed a challenge for us as anaesthesiologists. It is known that CHD can increase the severity of COVID-19 infection especially in the presence of pre-existing comorbidities, but there are limited studies exploring the interactions between COVID-19 and CHD in the background of pregnancy [5]. This is mainly due to the rarity of such cases. In one case report, Avila et al illustrated the disastrous outcome of COVID-19 disease in a pregnant lady with complex CHD [6]. So there is little evidence to make strong recommendations and management is reliant on our existing knowledge of ASD in pregnant patients and studies on other viral infections.

Our anaesthetic goals were prevention of aerosolisation and infection transmission, maintenance of preload and afterload, maintenance of sinus rhythm, avoidance of hypoxia, hypercarbia, hypothermia and hypotension and most importantly, prevention of paradoxical embolism. Prevention of infection of OT personnel is of utmost importance in the COVID-19 pandemic. In our case, Personal Protective Equipment (PPE) was worn during all interventions requiring close contact after the patient was suspected to have COVID infection. Our pre-anaesthetic evaluation involved evaluation of the patient's history, functional status and relevant investigations such as an ECG and 2D-ECHO. Assessment of the severity of COVID-19 was done based on the patient's symptomatology, a chest x ray, oxygen saturation and inflammatory markers. Based on this, we observed that she was having mild COVID-19 disease but the presence of pregnancy and elevated values of D-dimer suggested that she had a high risk of paradoxical embolism. Thromboprophylaxis should be considered in such patients and the implications of thromboprophylaxis and timing of neuraxial block should also be kept in mind. In our case, there was limited time due to the emergency of foetal distress and so pharmacological thromboprophylaxis could not be given. We used DVT pumps intra and post-operatively to prevent venous stasis. Sedative premedication for anxiolysis is beneficial in congenital heart disease as it helps to reduce myocardial oxygen consumption, but we avoided it due to the presence of COVID-19 disease and pregnancy [7]. We verbally reassured and counselled the mother to alleviate anxiety before and during the surgery.

Regional anaesthesia was considered because of its benefits such as decreased aerosolisation and infection spread, better postoperative analgesia and earlier discharge [8]. Post-spinal hypotension can be dangerous in patients with left-to-right shunts as it can cause shunt reversal and Eisenmenger Syndrome. We therefore used a low volume of hyperbaric Bupivacaine and ensured that spinal blockade level does not ascend above T4 dermatome. Hypoxia and hypercapnia precipitated by COVID-19 infection or high spinal anaesthesia can be dangerous as it can cause increase in pulmonary vascular resistance. So low flow oxygen was given to minimise chances of hypoxia and vigilant monitoring was done to prevent high spinal blockade. Although crystalloid co-loading is a recommended practice to prevent post-spinal hypotension [9], it was imperative to avoid an increase in preload in this patient as it can cause reversal of shunt. Phenylephrine is the vasopressor of choice to manage post-spinal hypotension in parturients, so we started Phenylephrine infusion prophylactically after giving spinal anaesthesia to prevent hypotension. Prevention of hypothermia and pain is important as they can cause sympathetic stimulation and increase left-to-right shunt.

Patients with an ASD measuring more than 4 mm are at increased risk of paradoxical embolism. This risk was very significant in our patient, who had a large Ostium Secundum-ASD measuring 3 cm [10]. So we ensured that air bubbles did not enter through the venous access sites, applied DVT pumps and encouraged early ambulation in the post-operative period. Vigilant monitoring was done in the intra-operative and post-operative period for symptoms of headache, altered sensorium and neurological deficits indicative of ischemic stroke or chest pain, and haemodynamic and ECG changes indicative of myocardial infarction. As oxytocin given for prevention or management of postpartum haemorrhage can cause chest pain, hypotension and transient ECG changes which can mimic symptoms

of paradoxical embolism [11] we avoided large bolus doses and used a slow titrated infusion of Oxytocin.

Our case was completed successfully without any perioperative adverse events keeping in mind the concerns discussed and both mother and baby were healthy. The mother was referred to the Cardiologist for ASD closure after she recovered from COVID-19. More research is the need of the hour to understand the implications of COVID-19 on CHD, increase generalizability and to improve patient management and outcomes.

Conclusion

In conclusion, the presence of COVID-19 disease in pregnant patients with atrial septal defect should be considered a risk factor for cardiovascular morbidity and paradoxical embolism. Management of these women should be done after due consideration of the severity of COVID-19 disease, physiological changes of pregnancy, the degree of existing cardiovascular impairment and a detailed knowledge of the underlying pathophysiology.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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