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CASE REPORT

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Tachyarrhythmia as a possible symptom of coronavirus in a neonate diagnosed with transposition of the great arteries

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Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic poses broad challenges to healthcare systems and providers. The manifestations of this disease are still being described in a variety of different contexts and patient populations.

Results: We report the case of a neonate who demonstrated COVID-19 after surgical correction of transposition of the great arteries. In addition, the patient demonstrated an evolving and persistent tachyarrhythmia consistent with neither the most likely postoperative complications nor typical COVID-19.

Discussion: The patient had negative preoperative testing for the virus and presented with profound oxygen desaturation and respiratory failure several days postoperatively. This raised concern for a complication of his arterial switch operation. It was found that one of the patient's caregivers was an asymptomatic carrier of COVID-19, and imaging ruled out intracardiac shunting. After initiating treatment for COVID-19, the patient's oxygen requirements and need for antiarrhythmic agents improved.

Conclusion: We propose that, despite negative preoperative testing, coronavirus infection may present as refractory tachyarrhythmia, and may be considered along with surgical complications as a cause for unexplained hypoxemia postoperatively.

KEYWORDS

congenital heart disease, COVID-19, cyanotic congenital heart disease, tachyarrhythmia, transposition of the great arteries

1 | CASE REPORT

In June 2020, a 6-day-old full-term infant diagnosed with transposition of the great arteries underwent an arterial switch operation (ASO) with closures of a large ventricular septal defect and a secundum atrial septal defect. The postnatal course before surgery was uneventful and the infant was tolerating oral feeds on room air. The findings of preoperative computed tomography angiography included side-by-side great vessels with slightly malaligned commissures and a circumflex taking off from the right coronary artery, all of which were confirmed intraoperatively. Following removal of the cross-clamp (time = 82 min) and cardiopulmonary bypass (time = 114 min), it was observed that the patient had a brief period of complete atrioventricular block that evolved into tachyarrhythmia before leaving the operating room. The patient was admitted to the cardiovascular intensive care unit where he remained intubated, on low-dose milrinone, epinephrine, and a nitroglycerin drip.

Later that day (postoperative day [POD] 0), the patient developed junctional ectopic tachycardia (JET) and right bundle branch block with a heart rate of 180–200 bpm. On POD 1, the persistent tachyarrhythmia and hypotension required the initiation of amiodarone boluses and procainamide drip for the former, and a vasopressin drip for the latter. On POD 2, the patient developed lactic acidosis, and atrial pacing was begun. Two days later, the patient's

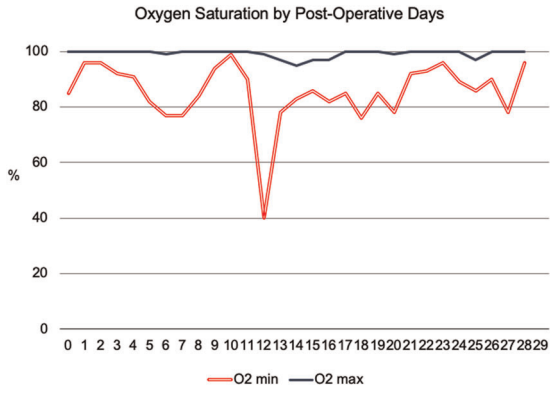

FIGURE 1 Oxygen saturations measured each day postoperatively. The patient's respiratory failure occurred on a postoperative day (POD) 12, as demonstrated by the steep decline to 40%. Saturations could not be elevated much beyond 80% for 8 days afterward, before finally surpassing 90% on POD 21

leukopenia and thrombocytopenia led to the patient receiving broad-spectrum antibiotics and work-up for culture-negative sepsis. On POD 5, the patient experienced a bradycardic event that devolved into a cardiac arrest requiring 3 minutes of compressions in addition to epinephrine, bicarbonate, and albumin boluses. The patient was weaned off of all interventions by the following day, and the JET resolved into sinus rhythm. On POD 8, the JET returned, concomitant with hypotension unresponsive to esmolol. Procainamide was reinitiated and failed to control the patient's tachyarrhythmia, at which point IV amiodarone was begun for breakthrough JET. On POD 12, his oxygen saturation deteriorated without explanation (Figure 1) and with only minimal radiological findings (Figure 2). The index of suspicion for a complication of the patient's ASO was high, and a bubble study ruled out left-to-right shunts as a cause of the hypoxemia. Persistent desaturation in the setting of a pandemic led to the patient's isolation, the initiation of IV heparin, and the collection of nasopharyngeal swabs from the patient, all staff members exposed to the infant, and the mother for reverse transcription COVID-19 polymerase chain reaction testing. Of all of those tested, only the infant and asymptomatic mother were positive for COVID-19 infection.

On POD 14, ferritin measured 1982 ng/ml and LDH was 627 U/L, raising concern for multisystem inflammatory syndrome in children (MIS-C). Rheumatology and infectious disease were consulted, and these services recommended starting anakinra 15 mg every 12 hours, decadron, and surfactant. On POD 15, the infant began a course of remdesivir with 5 mg/kg on the first day, then 2.5 mg/kg daily.

Over the subsequent 4–5 days, the patient's condition stabilized and improved. The JET remained controlled, and on POD 17, the patient was switched to oral amiodarone. On POD 24, the heparin and remdesivir were discontinued, and the following day the patient was weaned off of all vasoactive medication. On POD 26, the patient was extubated and placed on high-flow oxygen, progressing to low-flow nasal cannula by POD 30.

Despite substantial improvements in the clinical status, the infant continued to test positive for COVID-19 for almost 3 weeks. Following two successive negative tests on consecutive days, the isolation status was removed on POD 40. The overall improvement and down-trending brain natriuretic peptide levels led to discontinuation of the amiodarone on POD 43, and the infant was discharged to home care on POD 48.

2 | DISCUSSION

This report highlights several considerations for the postoperative congenital heart disease (CHD) patient during the COVID-19 pandemic. First, negative preoperative screening does not preclude the

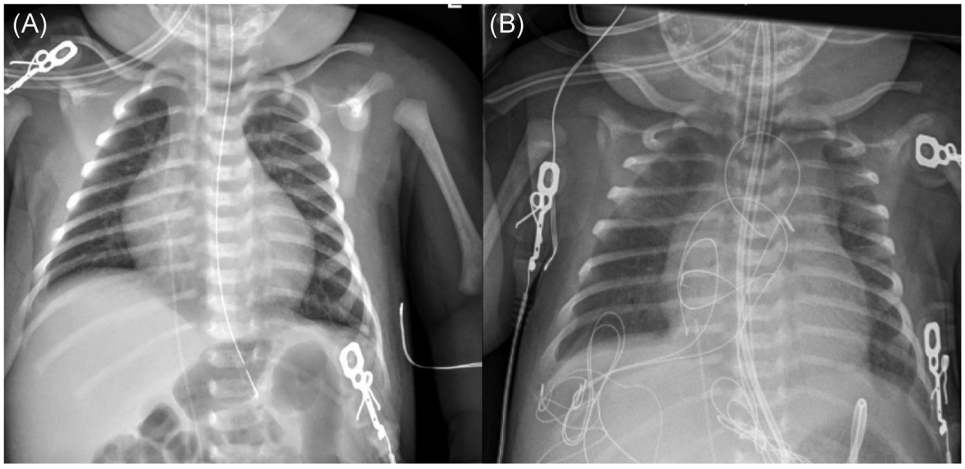

FIGURE 2 (A) AP chest X-ray on the day of surgery reported clear lungs, stable cardiac enlargement, no pleural effusions or pneumothorax is seen. (B) AP chest X-ray on postoperative day 12 reported the stable appearance of patchy added densities of the right upper and left lower lobe

possibility of postoperative infection, including patients that are continuously ventilated.[1] The wide incubation period (4–14 days) of the virus,[2] and the possibility of asymptomatic carriers mean that unexplained or unusual postoperative complications should lead to a low threshold for COVID-19 testing. Institutional policies to prevent infection similar to our hospital (preoperative testing for patients, temperature checks for all upon hospital entry, mandatory mask covers for everyone, random employee testing, etc.) do not fully protect pediatric patients from becoming infected by asymptomatic caregivers and rotating alternating providers after the negative preoperative screening.

Second, this patient's desaturation without an intracardiac shunt emphasizes that COVID-19 can mimic postoperative complications, while keeping in mind that postoperative complications due to the operation itself ought to be in the differential, even in the setting of a positive COVID-19 test. In cyanotic CHD, the hypoxemia of pulmonary COVID-19 may be missed when the surgeon assumes that such signs are linked to the procedure or the preoperative diagnosis.[3] In addition, the patient had JET that preceded his hypoxemia, and temporarily resolved after resuscitation on POD 5. The cause of this tachyarrhythmia was unclear, and it may be possible that it was linked to the ASO. However, Rhodes et al.[4] found a very low (1%–2%) incidence of all conductive anomalies following such ASOs. This fact, the recalcitrant nature of this patient's tachyarrhythmia, and its timing during the patient's postoperative course raise the possibility of early COVID-19 infection as the inciting factor. COVID-19 and prior beta-coronaviruses have been associated with tachyarrhythmias as a sign of direct myocardial infection.[5] It is also possible that the tachyarrhythmia is part of a newly described postviral syndrome seen in younger COVID-19 patients. The patient's elevated inflammatory markers mirrored what has been previously reported by the Center for Disease Control and Prevention in patients with lung injury, myocarditis, and other immune-mediated manifestations of MIS-C. As noted above, anakinra was administered when the laboratory markers of MIS-C began to develop. Although anakinra is not standard of care for COVID-19 and there were no randomized control trials demonstrating its benefit in acute COVID-19 infection, it was initiated due to promising observed benefits,[6] hypothesized to be a result of the similarity between MIS-C and macrophage activation syndrome. However, the patient did not demonstrate the classic myocarditis, pneumothorax, or pulmonary hemorrhage typical of the syndrome. There is also a discrepancy between the expected timing of MIS-C progression and that of this patient's symptoms. The patient's clinical improvement after initiating treatment for COVID-19 strengthens the hypothesis that the tachyarrhythmia may have been associated with the infection and the resulting complicated postsurgical course.

Third, anticoagulation serves to prevent postoperative thromboses,[7] and may suppress the hypercoagulability of severe COVID-19. Similar to the experience of Bezerra et al.,[8] anticoagulation was initiated because of its possible association with decreased mortality in severe COVID-19 disease.[9]

This case report is important for describing the possible postoperative clinical course of neonates with CHD and COVID-19 infection. Given the large variety of COVID-19 clinical manifestations in children, postoperative dysrhythmias in infants with CHD that cannot be explained by the surgical intervention, residual lesions, or that do not follow a typical course of recovery or response to therapy, should prompt further evaluation including COVID-19 testing despite negative preoperative screening.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

ETHICS STATEMENT

Ethical approval was waived by the Ethics Committee of Children's of Alabama in view of the retrospective nature of the study and all the procedures being performed were part of routine care. Informed consent was obtained from the parents. The patient's parents have consented to the submission of the case report to the journal.

AUTHOR CONTRIBUTIONS

All authors contributed to the case report's development. Material preparation, data collection and analysis were performed by Luz A. Padilla, Robert J. Dabal, and Raymond A. Lopez. Added commentary and input from direct care providers was given by Leslie A. Rhodes, Robert A. Sorabella, Robert J. Dabal, and David C. Cleveland. The first draft of the manuscript was written by Raymond A. Lopez, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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