

## Brief Report

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**Abstract**

We report a series of four patients with CHD who tested positive for COVID-19, got treated, and underwent cardiac surgery in the same sitting. All had an uneventful perioperative course similar to COVID-19-negative patients. We conclude that children with asymptomatic or mild COVID-19 disease may be subjected to surgery as early as within 1 week since COVID-19 negative.

COVID-19 infection is known to inflict a life-threatening course in those with comorbid illnesses. Very meagre literature on CHD and COVID-19 disease has been published. They can contract severe COVID-19 disease if infected due to cyanosis, heart failure, pulmonary hypertension, cardiac cachexia, malnutrition, and immunocompromised states. During the second wave preoperative screening, all elective cases with COVID-19 positive were scheduled later. Four children needed emergent or urgent surgery. Hence, considering the benefits outweighing the risks, these children were treated for COVID-19 and then operated once negative.

**Case report**

Tetralogy of Fallot was the primary diagnosis in three patients with incessant, frequent cyanotic spells not controlled by medical management and one child had a large perimembranous ventricular septal defect with recurrent lower respiratory tract infections and severe failure to thrive weighing 4.5 kg at 9 months of age. Such patients are highly susceptible to a life-threatening infection if affected with severe COVID-19.<sup>1</sup>

All patients but for one were asymptomatic for COVID-19 disease. The symptomatic child with Tetralogy of Fallot exhibited a mild COVID-19 disease. These patients needed an urgent addressal of their heart defect and hence were admitted and treated for COVID-19. They underwent a baseline complete blood count, liver function tests, C-reactive protein, partial thromboplastin time, prothrombin time, and a chest X-ray. Chest X-rays revealed the pulmonary vascularity in congruence with underlying heart defect with no parenchymal or interstitial infiltrates. C-reactive protein was elevated marginally in three patients with highest value of 8.8 mg/L in a Tetralogy of Fallot patient as shown in Table 1. Cyanotic spells precipitated a dangerous decline in the saturation of Tetralogy of Fallot patients which were managed with supplemental oxygen, intravenous fluids, and beta-blockers titrated to effect. COVID-19 disease was conservatively managed with prophylactic antibiotics, adequate hydration, and multivitamins with strict adherence to isolation and COVID-19 appropriate behaviour. C-Reactive protein was repeated every 48 hours for a quantitative analysis. A repeat COVID-19 antigen test was done when these children exhibited an asymptomatic period for at least 72 hours and negative repeat C-reactive protein. The positive child was given continued care in COVID-19 facility till tested negative. Once negative, they underwent surgical correction without further delay. The time to test COVID-19 negative from admission, and negative result to surgery is given in Table 1.

The three Tetralogy of Fallot patients underwent a complete intracardiac repair, and the ventricular septal defect child underwent a pericardial patch closure of ventricular septal defect under cardiopulmonary bypass. All patients received intravenous dexamethasone 0.2 mg/kg after induction to circumvent the inflammatory response on pump.<sup>2</sup> Postoperative course was uneventful, and all were fast tracked. None of the patients needed upgradation of antibiotics or steroids. They were weaned off oxygen by 3rd postoperative day and discharged within 1 week.

**Discussion**

Since COVID-19 pandemic has been declared across the globe, with the health care fraternity combating this disease, the elective surgical work has been affected. With the emergence of the second wave, most of the hospitals being COVID-19 care centres simultaneously addressing

**Table 1.** Registry of cases.

Sr no.	Age/sex	Diagnosis	COVID-19 symptoms at admission	CRP baseline	Time to COVID-19 negativity from admission	CRP post COVID-19 negative	CHD symptoms	Indication for addressal of primary heart disease	Duration from COVID-19 negative to surgery	Postoperative course	Any complications	Ventilation time	ICU stay	Post op hospital stay
1	10 months/F	Tetralogy of Fallot	Asymptomatic	4 mg/L	9 days	2.4 mg/L	Cyanosis, suck rest suck, saturation 80%	Cyanotic spells	4 days	Uneventful	No	28 hours	3 days	7 days
2	1 year 6 months/M	Tetralogy of Fallot	Cold cough fever	8.8 mg/L	13 days	3.2 mg/L	Cyanosis, saturation 65%	Poor weight gain, cyanosis	5 days	2 spikes of fever	No	3 hours	2 days	7 days
3	1 year 9 months/M	Tetralogy of Fallot	Asymptomatic	5.2 mg/L	8 days	2.6 mg/L	Cyanosis, saturation 40% recurrent spells	Cyanotic spells	2 days	Uneventful	No	2 hours	3 days	5 days
4	6 months/M	Ventricular septal defect	Asymptomatic	2.6 mg/L	10 days	1.8 mg/L	Suck rest suck, extreme failure to thrive, poor weight gain, H/O pneumonia	Extreme failure to thrive, poor weight gain	2 days	Uneventful	No	2.5 hours	2 days	6 days

other primary specialities like paediatric cardiac surgery, entails subjecting these kids to a greater risk of contracting COVID-19 and its subsequent consequences in the perioperative period. This has led to a conservative approach to manage elective cardiac surgeries.<sup>3</sup>

There are limited data regarding the effects of COVID-19 in the paediatric age group and their vulnerability to develop severe COVID-19 disease. However, the Chinese centre for disease control and prevention showed that children less than 10 years constituted only 1% of COVID-19 cases.<sup>4</sup> It has been theorised to be less infectious in children as ACE2 (the binding protein for SARS-CoV-2) is not as functional as compared to adults.<sup>4</sup> With continued new strains emerging with each wave, a subsequent wave is expected to affect children to a larger extent.

During the second wave in a span of 1 month, four children with CHD positive for COVID-19 presented with mild symptoms or asymptomatic with a moderate rise in the C-reactive protein levels. They were treated symptomatically for COVID-19. Based on the crisis management strategies by Stephens et al, we took the challenge of operating these children in the same sitting after treating COVID-19 to avoid life-threatening conditions.<sup>5</sup>

In order to avoid a stormy perioperative period and outcome, we followed the concepts laid down by Levy et al<sup>6</sup> and Giordano et al.<sup>4</sup>

As per the recommendations from the congenital cardiac anaesthesia society, intraoperative use of steroids to mitigate the inflammatory response of bypass and also fast tracking of these children helped in early recovery.<sup>2</sup> We had no morbidity or mortalities in this subset.

The outcomes of post COVID-19 in paediatric patients undergoing interventions are unknown but we found all our patients behaved similar to their non COVID-19 counterparts postoperatively similar to an adult cohort study by Lopez-Marco et al.<sup>7</sup> In a study by Rosati et al, among 259 elective adult cases, 2 patients positive with RTPCR and 15 with 2–4 CO-RAD score on CT scan showed no increase in periprocedural complications after surgery.<sup>8</sup> Many studies show increase in morbidity and mortality in patients diagnosed with COVID-19 postoperatively.<sup>9</sup> Sanders et al demonstrated better outcomes if COVID-19 was diagnosed preoperatively than postoperatively.<sup>10</sup>

Based on our experience, we would like to emphasise the benefits of addressing a child with CHD should be weighed against the risks of these kids surviving the dual battle against uncorrected CHD and a concurrent COVID-19 illness. Hence, timely intervention will help avoid untoward outcomes in them.

A wait for the termination of COVID-19 pandemic is unjustifiable in select cases and will render most of these patients inoperable or succumb to the primary illness of CHD. Hence, an attempt has been made to share our small experience to revisit the strategies of a conservative approach to the speciality of congenital heart surgery. We suggest that surgeries may be performed safely on children with critical heart disease who recovered from a recent COVID-19 illness as early as 1 week. However, our recommendations need to be validated by a large-scale study.

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**Conflicts of interest.** None.

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