Extracorporeal Membrane Oxygenation Support for a Young Child with COVID-19 Related Respiratory Illness.

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Introduction

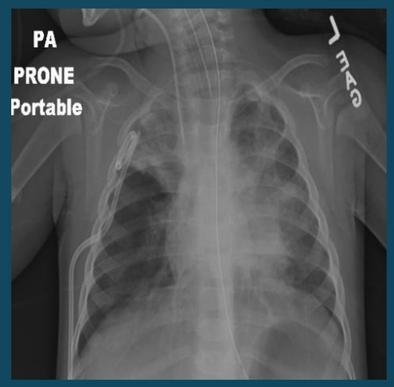
Coronavirus 2019 (COVID-19) is the cause of the most recent pandemic, most notably with concern for Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The treatment of the COVID-19 infection has been an area of intense study throughout the pandemic. The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) caused by the COVID-19 virus has had variable presentation from asymptomatic carriers to severe acute respiratory distress syndrome (ARDS) and respiratory failure[6, 9]. Pediatric patients in particular had a tendency toward more mild illness through the initial waves of the pandemic, though per the CDC, there has been a significant increase in pediatric hospitalizations after the spread of the Omicron variant[2,3]. As more patients are failing mechanical ventilation, there has been variable response across different centers opting to trial extracorporeal membrane oxygenation (ECMO), as many initial reports suggested high rate of mortality, especially in the older populations[5]. We present a case of a previously healthy 12-month-old male found to have COVID-19 infection who continued to worsen on mechanical ventilation and ultimately successfully treated with veno-venous ECMO (VV-ECMO).

Case Description:

A 12-month-old male with a history of recurrent acute otitis media requiring tympanostomy tube placement just prior to an initial presentation to the hospital with 3 day admission for COVID pneumonia. Per the initial report, the patient had experienced increased fussiness, fatigue, and fever for 1 day and was found to be hypoxemic to 84% on arrival. Viral respiratory PCR panel by nasopharyngeal swab was obtained and found positive for COVID-19. He was otherwise healthy and was discharged after showing signs of initial recovery with maintained saturations >90% on room air after a maximum of 1 liter, 100% oxygen by nasal canula and otherwise supportive care only. He represented to the emergency department 24 hours after discharge with worsened cough and tachypnea, and again found to be hypoxemic to 85%. He was placed back on supplemental oxygen at 2 liters by nasal canula to maintain saturations >90%. On day two of his admission, his respiratory status continued to worsen along with his hypoxia and oxygen requirement. He was started on Dexamethasone, Remdesivir, and Enoxaparin; though Remdisivir was discontinued after day 2 of treatment due to acute elevation in liver enzymes. He continued to have worsening clinical status that ultimately required transfer to the pediatric intensive care unit (PICU) where he was endotracheally intubated and placed on mechanical ventilation and was found to have a right-sided pneumothorax which required a chest tube placement.

Case Description con't

On day three in the PICU, his hypoxia continued to worsen despite increasing ventilator settings and prone positioning, though he was not a candidate for high frequency oscillatory ventilation (HFOV) due to the risk of spreading the virus through the machine valves. As his hypoxia continued to worsen with his oxygenation index (OI) rising from 28 at seven hours mark before initiating ECMO to 37 at one hour mark, the decision was made to place him on VV ECMO. He was cannulated through the right internal jugular vein using a 16 french Bi-caval cannula (Avalone, Maquet, Getinge Group, Kehler Str. 31, 76437 Rastatt, Germany). The child was on ECMO support for total of 9 days, his ECMO course was uneventful, aside from occasional recirculation from the suboptimal cannula position. He was extubated 4 days after de-cannulation and was weaned to room air 5 days after the extubation. The patient's length of stay in the hospital was 31 days, and he was discharge home after brief rehabilitation with no respiratory or neurologic sequelae.



Chest X-rays before (top) and after (bottom) ECMO cannulation.

Discussion:

Data reported early in the COVID-19 pandemic showed that children usually develop a mild form of the disease and rarely require intensive medical treatment[4]. Through the initial 2 waves of the pandemic, pediatric patients continued to present with only mild forms of the illness[10]. As such, it was anticipated that the third wave had a low likelihood of causing severe illness, though our institution saw a significant increase in severity of illness and concurrent increase in PICU admissions from SARS-CoV-2 toward the end of 2021. Though there has been variable use of ECMO treatment for COVID-19 infections in pediatrics across the nation[12], our institution elected to offer ECMO to this population early in the pandemic in the absence of additional contraindications. Our patient was the youngest child in our institution to be placed on ECMO support for SARS-CoV-2 infection. We followed our current protocol in candidacy, cannulation, and medical management including resting mechanical ventilation settings, anticoagulation therapy, and monitoring, considering the updated guidelines from the Extracorporeal Life Support Organization (ELSO)[1]. There has now been increasing evidence of good outcomes in pediatric COVID-19 patients treated with ECMO[4,6,8,11], and this case adds support that early ECMO initiation can decrease mortality in pediatric COVID-19 patients and should be a serious consideration for patients failing other classic forms of treatment for respiratory failure in the setting of COVID-19.

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Consent: a written informed consent to publish this case report was obtained from the patient's guardians.

Abbreviations

ECMO: Extracorporeal Membrane Oxygenation
ARDS: Acute Respiratory Distress Syndrome
PICU: Pediatric Intensive Care Unit