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Case Report

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Azerbaijan's first successful ECMO patient management – 4 year survival

Abstract

We present the first successful Extracorporeal Membrane Oxygenation (ECMO) case in our Azerbaijan. After 5 days of ECMO support, the patient have been weaned from ECMO. Following that period, the application of ECMO support has remained an ongoing practice within our clinic. Consequently, we have undertaken the deliberate initiative of presenting an extensive follow-up of 4 years for our pioneering ECMO patient.

Keywords: Extracorporeal membrane oxygenation, congenital heart disease, low cardiac output syndrome

INTRODUCTION

Extracorporeal Membrane Oxygenation (ECMO) has emerged as a pivotal therapeutic strategy for managing severe cardiac and respiratory failure refractory to advanced medical interventions. Its origins trace back to 1972 when Hill and colleagues used it for treatment of acute respiratory distress syndrome. In the pediatric population, the application of ECMO gained traction with Baffes et al.'s 1970 report on its successful use following congenital heart surgery (1).

Advancements in surgical techniques have broadened ECMO's scope, encompassing acute cardiac and respiratory crises. Notably, ECMO has evolved as a crucial support measure for cardiopulmonary failure due to conditions like COVID-19, including acute respiratory distress syndrome, myocarditis and multi-systemic inflammatory syndrome in children (MIS-C) (1,2). Within the pediatric congenital heart disease (CHD) population, ECMO addresses cardiac or cardiorespiratory failure precipitated by pre-operative hemodynamic instability, post-operative low cardiac output syndrome (LCOS), and difficulties in weaning from cardiopulmonary bypass (CPB). Recent studies underline the efficacy of ECMO during cardiopulmonary resuscitation (ECPR), particularly in the pediatric population (2-4). This paper details the case of Azerbaijan's first successful ECMO patient.

CASE

The case pertains to an 11-month-old male with doubly-committed ventricular septal defect (VSD) and atrial septal defect (ASD). Surgical closure of both defects on CPB was performed without complications on 22.10.2019. After the surgery patient was transferred to the intensive care unit (ICU). However, postoperatively, signs of LCOS emerged. Despite high inotropic support, hypotension, acidosis, and elevated lactate levels persisted. ECMO candidacy was confirmed, cardiovascular surgery and perfusion team was called. However, during the preparation phase, a cardiac arrest ensued. The sternum was promptly re-opened, central cannulation was executed (involving the aorta and right atrium), and ECMO support was initiated under resuscitation (ECPR). Rotaflow centrifugal blood pump (MAQUET Cardiopulmonary AG, Hirrlingen, Germany), Terumo FX05 pediatric oxygenator, heat exchanger and neonatal tubing set were used in the ECMO system. ECMO initiation led to immediat hemodynamic amelioration, gradual reduction in inotropic support, and a five-day ECMO period (Figure 1).

Successful weaning from ECMO followed by sternum closure on the 6th postoperative day culminated in extubation (10th day) and ICU discharge on the 15th postoperative day. The patient presented favorable evolution and was discharged from hospital on 20th postoprative day without any neurological sequela. Chest radiograph during ECMO (Figure 2) and before hospital dicharge (Figure 3) are showed.

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The patient's postoperative follow-ups have consistently revealed favorable progress, including the latest assessment conducted in 2023, marking a four-year survival since discharge.

Figure 1. The image depicts a patient receiving Extracorporeal Membrane Oxygenation (ECMO) support. The central cannulation involves the aorta and right atrium, while the sternum left open

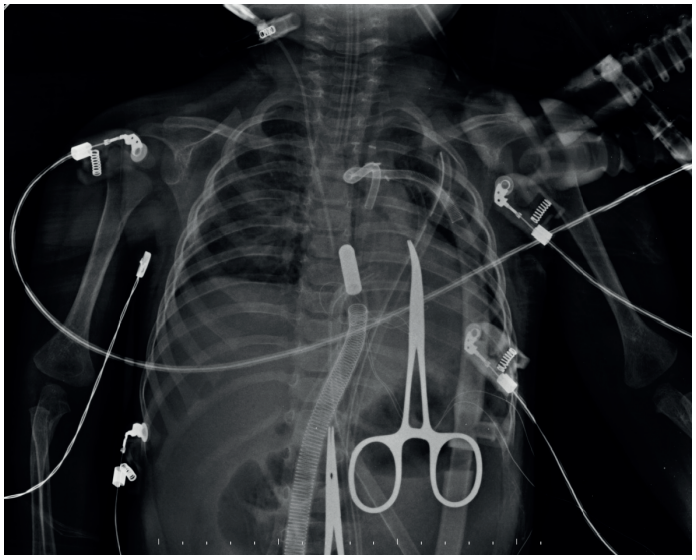

Figure 2. Chest radiograph of this patient during ECMO support

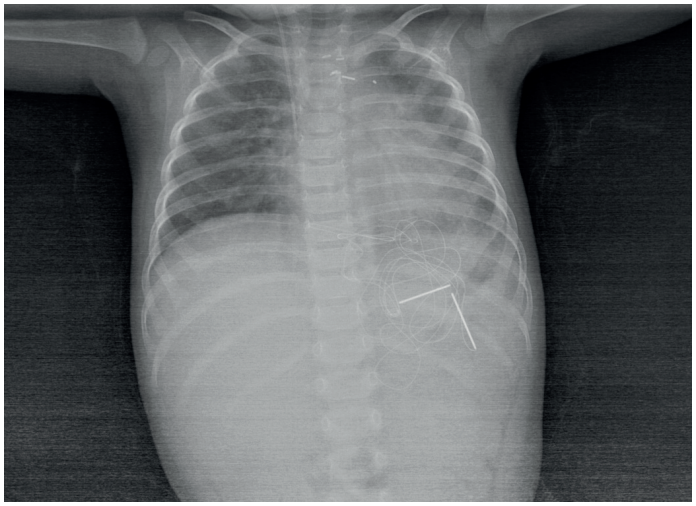

Figure 3. Chest radiograph of this patient before hospital discharge

DISCUSSION

Traditionally, postoperative pediatric ECMO was used generally in difficulty of weaning off the bypass during postoperative period. Nowadays, the use of ECMO in pediatric population is increased and the resent studies show improvement of survival rates inpediatric population with the use of ECMO (1,2). All these possibilities arise the need for ECMO. In the pediatric ECMO population, we encounter children of varying weights and ages, from newborns weighing a few kilograms to older children weighing 50-60 kg. In the pediatric ECMO population, we mate different children in different weigh and age, varrieng from newborns weighing a few kilograms to older children. To this end, different ECMO circuits and cannulas are used in response to these weights.

Post-operative heart failure, heart failure of any kind or conditions requiring cardiopulmonary resuscitation (CPR) are main indications for the implantation of an ECMO. Within the pediatric congenital heart disease population, ECMO is most commonly required for post-operative support. Post-operative cardiac dysfunction can manifest in a failure to wean from CPB or development of LCOS in the intensive care unit, with persisted hypotension, acidosis, and elevated lactate levels despite high inotropic support.

LCOS affects around 10-25% of children who undergo cardiac surgery. It's marked by reduced cardiac output and inadequate blood supply to organs. This leads to higher lactate levels, increased difference in arterial-venous oxygen saturation, and oliguria within 24 h after surgery. Although many LCOS cases are treated with medication, if a patient continues to show disfunction and end-organ hypoperfusion despite optimal medical treatment, the use of ECMO should be considered. Timing is very important in these patients, because their condition can deteriorate very quickly. In our case also, the patient’s condition deteriorated rapidly and ECMO was inserted during CPR.

The inception of pediatric ECMO program within our institution dates back to 2018, marking the commencement of a transformative phase. Notably, the case under discussion stands as a monumental milestone — first successful patient that weaned from ECMO and discharged in our country. Following that period, the application of ECMO support has remained an ongoing practice within our clinic. Consequently, we have undertaken the deliberate initiative of presenting an extensive follow-up of 4 years for our pioneering ECMO patient.

CONCLUSION

Traditionally, ECMO has been of high importance in pediatric and neonate population, and its use has been increasing in recent years. ECMO can be used in many patients with severe heart and respiratory failure. Notably, the case study presented herein represents a pioneering occurrence wherein ECMO support was administered, culminating in an uneventful patient discharge — a novel milestone within our nation's medical landscape.

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Evolution of extracorporal modalities within specialized medical facilities across our country assumes a position of essentiality, paralleled by an augmentation of comprehensive experiential insights. Proper patient selection and timely initiation of ECMO support is very important.

Conflict of Interests: The authors declare that there are no conflict of interests.

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Patient Informed Consent: Informed consent was obtained from the patient(s).

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