Use of extracorporeal membrane oxygenation for postoperative cardiac arrest in patient after repair of VSD and aortic coarctation

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Abstract:
Extracorporeal membrane oxygenation can be an effective form of management for postoperative cardiac or pulmonary failure that is refractory to medical management with published favorable outcomes in 25-50% of patients. We describe the successful use of rescue ECMO in a 6 week old who developed junctional ectopic tachycardia and ventricular fibrillation resistant to standard advanced life support after repair of ventricular septal defect and coarctation of the aorta.

Case Report:

Preoperative Course:
6 week old 5.5 kg term male was admitted to the hospital with respiratory distress and decreased systemic function. He was noted to have a murmur on physical exam as well as an enlarged cardiac silhouette on x-ray. Echocardiogram revealed ventricular septal defect. Patient underwent uneventful cardiac catheterization which confirmed aortic coarctation as well as VSD.

Intraoperative Course:
He presented for repair of ventricular septal defect and coarctation of the aorta. Induction and surgery proceeded uneventfully with 209 minutes of cardiopulmonary bypass and 79 minutes of cross clamp. Patient had difficulty separating from bypass and required calcium chloride, amiodarone, epinephrine, and milrinone infusions as well as defibrillation twice in the OR after separation from bypass. Decision was made to leave patient’s chest open.

Postoperative Course:
Patient was transported to PICU on milrinone, epinephrine, amiodarone, and calcium chloride infusions in stable condition. 20 minutes after PICU arrival, EKG changes consistent with junctional ectopic tachycardia were noted followed by loss of blood pressure and ventricular fibrillation was noted. Immediate CPR was initiated with PALS guidelines followed for medications and defibrillation. Open cardiac defibrillation and massage were attempted without success. Decision was made to institute ECMO with ascending aorta and SVC and IVC cannulation. There was 43 minutes of resuscitation after cardiac arrest before ECMO was started. Two days later patient was re-cannulated at the right carotid artery and right internal jugular vein due to poor perfusion of the proximal ascending aorta and coronary arteries as demonstrated by transesophageal echocardiography. Patient remained on ECMO with successful separation on day 7. Patient remained in the hospital for an additional three weeks prior to discharge home in good condition. 14 month followup revealed normal functional neurological status.

Complications and Outcomes:
- Overall survival after extracorporeal cardiopulmonary resuscitation ranges from 33-46%.
- Chances of survival are greater in those requiring < 72 hours of ECMO support.
- Some studies report more favorable outcomes with early initiation of ECMO.
- Cannulation of neck vessels seems to have a beneficial effect on outcome in some studies.
- Implementation of ECMO > 30 minutes from arrest time appears to increase mortality.
- Major complications include sepsis, renal failure, and intracranial hemorrhage.
- Normal functional neurological status is seen in 40% of those that survive.

Key Learning Point:
Rescue ECMO has been shown to be essential to the successful treatment of refractory cardiac arrest, with survival to discharge in 25-50% of patients; favorable neurologic outcomes are seen in the majority of these patients. ECMO should be considered in pediatric postoperative cardiac patients when conventional resuscitation measures are unsuccessful. Neck vessels should be considered as initial cannulation site if possible or recannulation should be considered to ensure adequate coronary perfusion. We present this case as a favorable outcome with use of rescue ECMO.

Extracorporeal Cardiopulmonary Resuscitation for postoperative cardiac patients

- The American Heart Association’s guidelines suggest that any patient with refractory cardiac arrest and potentially reversible cause of cardiac arrest is a candidate for extracorporeal cardiopulmonary resuscitation.
- Use of rescue ECMO in cardiac patients has increased and survival rates have been reported similar to or better than those of noncardiac patients.
- Comparison between CPR alone and CPR plus ECMO shows a difference to survival to discharge of 12-23%.
- Use of ECMO is more effective than CPR alone in witnessed cardiopulmonary arrest in children.
- Extracorporeal cardiopulmonary resuscitation rescues approximately one-third of patients in whom death is otherwise certain.

References: