Predictors of mediastinal exploration while on extracorporeal membranous oxygenation after pediatric cardiac surgery.

Time to cannulation and bleeding outcomes

The time to the outcome for the patients cannulated in operating room (OR) was calculated by subtracting the OR exit time from the time of bleeding outcome. The time to outcome for the patients cannulated in the CICU was obtained by subtracting time of ECMO cannulation from the time of bleeding outcome. The time from ECMO cannulation to surgical end time was obtained by observing the time difference between the OR exit time and the time of cannulation.

ECMO Anticoagulation Protocol

At the time of CPB cannulation, patients receive 350 units/kg heparin. There is typically no additional anticoagulation agent administered to the patient or ECMO circuit prime at the time of conversion from CPB to ECMO in the OR; instead a patient is reversed with protamine. When patients are transitioned from cardiopulmonary bypass to ECMO, a half-dose of protamine (2 mg/kg) is given in the operating room. The activated clotting time (ACT) is subsequently followed and if >200 sec after 3-5 minutes, a second dose of 2 mg/kg of protamine is given. Patients arrive in the CICU and the timing of heparin initiation is determined by the attending cardiac intensivist and cardiac surgeon. No additional bolus of heparin is given and patients are started at 20 units/kg/hour once the surgeon and intensivist have determined that bleeding has subsided. No heparin is initiated on ECMO if there is ongoing bleeding.
Patients cannulated in the CICU are given 100 units/kg heparin at the time of cannulation. Variable amounts of heparin (0-500 units) can be added to the pump prime based on the prior status of hemostasis, a patient’s weight, and the surgeon’s discretion. A continuous heparin infusion is started 10-15 minutes after achieving full flow ECMO at a standardized dose of 20 units/kg/hour. The ACT is followed hourly and serial adjustments made if necessary, prior to obtaining first the aPTT and anti-Xa levels. Once on ECMO, anticoagulation is primarily managed by evaluating the aPTT and anti-Xa level for unfractionated heparin with a goal aPTT of 70-105 sec and anti-Xa level of 0.3-0.7. Heparin doses are increased or reduced based on serial values, with repeat testing 4 hours after any change. ACT and thromboelastography (TEG) testing are used as additional tests to assist in interpretation of anticoagulation, especially if there is discrepancy between the aPTT and anti-Xa levels. Blood products are given to maintain a goal of platelets >100 x 10^9/L, hemoglobin > 10 g/dL and fibrinogen >150 mg/dL. Direct thrombin inhibitors, most commonly bivalirudin, are reserved for a history of heparin allergy or evidence of heparin-induced thrombocytopenia.