Abstract #8

ECHOCARDIOGRAPHIC EVALUATION OF THE AVALON ELITE BI-CAVAL DUAL LUMEN CATHETER IN NEONATAL AND PEDIATRIC VV ECMO

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Introduction: New dual lumen catheters have led to improved flow dynamics during neonatal and pediatric VV ECMO. However, placement techniques vary by institution and lack standardization. For the past year, our institution used echocardiography (echo) to guide placement for all Avalon Elite bi-caval dual lumen VV ECMO cannulations. Over the course of the year, the use of echo allowed us to make observations regarding the location of each individual port of the Avalon catheter within the atrium and vena cava. This information is particularly relevant to the dual lumen cannulas, which are designed to be placed so that the draining ports lie within the SVC and IVC, and the infusion port lies inside the right atrium, where it can return oxygenated blood to the body.

Methods: We performed a retrospective review of all patients who underwent dual lumen VV ECMO cannulation at our institution in 2009. The echos were reviewed with a pediatric cardiologist to confirm measurements including: right atrium (RA) size, location of the cannula tip, and location of the ports. We performed a chart review of these six patients to determine the cannula size, flow rates, pre- and post-membrane pressures, patient and circuit arterial and venous oxygen saturations, circuit FiO2, and lactate levels. We hypothesized that correct placement of the catheter ports would result in improved flow dynamics on VV ECMO.

Results: We reviewed 11 echos from six patients; four were neonates and two were pediatric. Three patients had additional echos due to changes in clinical status. All three catheter ports (SVC, IVC, infusion) were identified in their intended location in 6/11 echos, and circuit flow rates at the time of these echos averaged 112.6 mL/kg/min. Only 2/3 ports were in the correct location in 4/11 echos, which resulted in an average flow of 81.8 mL/kg/min. Only 1/3 ports were in the correct position in 1/11 echos, wherein the flow rate was 36.4 mL/kg/min. Independent neonatal analysis showed average flow rates of 112.1 mL/kg/min (3/3 ports correct) and 59.5 mL/kg/min (2/3 ports correct). The five-year-old patient underwent four echos and the maximum diameter of the right atrium varied widely (2.92-4.05cm) between echos. This patient was unique in that the infusion port was initially misplaced superiorly in the SVC, despite proper positioning of the SVC and IVC ports. Circuit flow averaged 89.3 mL/kg/min in this position, but improved to 115.0 mL/kg/min when the infusion port was advanced to the SVC/RA junction. The maximum catheter depth in all echos was 2.52cm below the IVC/RA junction.

Conclusions: This is the first case report describing the use of echocardiograms for the assessment of dual lumen catheters during VV ECMO. Echos were able to define the position of all three catheter ports in the majority of cases. Preliminary data suggest that correct placement of these ports within the SVC, IVC, and right atrium is associated with increased ECMO circuit flow. Future studies are needed to confirm these findings and to further evaluate optimal catheter design. These studies should define a standard echocardiographic imaging plane, anatomic reference points, and catheter measurements.