

## **Novel Modifications of a Ventricular Assist Device for Infants and Children**

Michael C. Mongé, Bradley T. Kulat, Osama Eltayeb, Shyamasundar Balasubramanya, Anne E. Sarwark, Neale R. Zingle, Steven T. Moss, Michael Alice Moga, Elfriede Pahl, John M. Costello, Carl L. Backer

**Purpose:** We modified a continuous flow “adult” ventricular assist device (VAD) to support infants and children waiting for heart transplantation, and report our outcomes. Components for VAD set-up (cannulas, grafts, and connectors) are readily available in any cardiac operating room.

**Method:** A commercially available centrifugal VAD was used to bridge pediatric patients to heart transplantation. The device is designed to flow from 1.5 to 8 L/min. In smaller children and infants, a modified recirculation shunt was added to permit lower flow ranges (down to 700 cc/min). In hypoxic patients, an oxygenator was spliced into the circuit.

**Results:** From 2010 to 2014 the VAD was placed in 11 consecutive patients. Age ranged from 0.9 to 16 yrs (median = 7 yrs). Body surface area ranged from 0.4 to 2.1 m<sup>2</sup> (median = 0.9 m<sup>2</sup>). Seven patients were less than 1.0 m<sup>2</sup>. Four patients were on ECMO prior to VAD and 2 had single ventricle/Glenn physiology. Three patients had a recirculation shunt and 3 had use of an oxygenator. Median time on the VAD was 11 days (range 2 to 79 days). In patients with a recirculation shunt, mean patient flow was 1.3 L/min, mean shunt flow was 2.0 L/min. All patients were transplanted, survived, and discharged at a median of 26 days (range, 17-83 days) post-transplantation. There were no infections. There was 1 cerebrovascular accident. Wait list mortality dropped from 10% (5/52) to 3% (2/68) (2007-2010 vs 2011-2014) ( $p = 0.24$ ). VAD mortality dropped from 33% (3/9) to 0% (0/11) ( $p=0.07$ ).

**Conclusions:** The centrifugal VAD successfully supported pediatric patients awaiting heart transplantation. The modified recirculation shunt allows patient flows as low as 700 mL/min. The design facilitates placement of an in-line oxygenator. Compared to traditional pulsatile devices, use of this VAD was associated with a trend toward decreased waitlist and VAD mortality.