A Novel Intracorporeal Right Ventricular Assist Device Implant Technique in a Young Patient

Objective: Controversy exists regarding optimal device selection and long-term strategy for biventricular support in children and small adults. Use of intracorporeal devices such as the Heartmate 3 (HM3, Abbott Laboratories, Chicago, IL, USA) for both left ventricular assist device (LVAD) and right ventricular assist device (RVAD) can allow for home discharge, but HM3 RVAD implant is limited by cannulation location, flow rates, and space in the intrathoracic cavity. Direct right atrial cannulation technique on its lateral wall has been performed, but it can be complicated by inflow obstruction from tricuspid valve leaflets, or chronic right lung compression with resultant atelectasis or pulmonary vein stenosis. To avoid these issues, we employed a new implant technique that positions the HM3 RVAD pump away from these structures while still maintaining optimal pump inflow.

Methods: We present a case of successful, durable, intracorporeal biventricular assist device (BiVAD) placement in a nine-year-old, 38kg (BSA 1.4m2) patient. The patient has a history of dextro-transposition of the great vessels, status post neonatal arterial switch, who presented with syncopal episodes with exercise thought to be secondary to coronary stenosis or myocarditis. She progressed to shock and underwent urgent veno-arterial extracorporeal membrane oxygenation (ECMO) cannulation. When ventricular function did not improve after 13 days of ECMO support with septostomy for ventricular unloading, she underwent intracorporeal LVAD (HM3) and temporary RVAD placement (Centrimag, Abbott Laboratories, Chicago, IL, USA). She could not be weaned from her temporary RVAD after 20 days of mechanical support, and was taken for durable RVAD placement (HM3). In order to accommodate a pump without right lung compression, a pocket was created for the HM3 pump between the posterior sheath of rectus abdominus muscle and the right diaphragm under the rib cage. A ringed 20mm polytetrafluoroethylene graft (Gore, Flagstaff, AZ, USA) was then sewn to the right atrial wall and was connected to the HM3 inflow. This inflow configuration avoids pump protrusion into the right atrium and potential inflow obstruction from tricuspid valve leaflets without requiring tricuspid valvectomy. The outflow was then sewn to the pulmonary artery in the standard fashion. A pulmonary valve replacement was performed given the patient's history of severe pulmonary valve insufficiency. She was extubated on postoperative day six. Her postoperative course was complicated by temporary left vocal cord paresis and deconditioning requiring inpatient rehabilitation. She was able to be discharged home 62 days following RVAD placement and continues to do well awaiting cardiac transplantation.

Results: This case demonstrates a novel method of intracorporeal RVAD placement that can be used in children or small adults to successfully support the right ventricle and allow for discharge home while awaiting cardiac transplantation. By positioning the VAD pump away from the heart and right lung, this technique avoids tricuspid valve leaflet interference or pulmonary compression that can complicate RVAD placement in smaller patients.

Conclusions: This RVAD placement technique can be considered in smaller patients to facilitate home discharge and rehabilitation.
