Dual Propeller Micro-Pump and TCPC Smart Connector for Superior Hemodynamics and Cavopulmonary Support

Published date: Oct. 11, 2016

Technology description

For paediatric population and children with single functional ventricle, Fontan operation helps to reroute the deoxygenated blood to the lungs. The Total Cavopulmonary Connection (TCPC) is usually the method opted by the clinicians to surgically attach the superior vena cava (SVC) and inferior vena cava (IVC) to the left and right pulmonary artery. However, the non-physiologic flow patterns created by the Fontan procedure lead to an increase in chances of thrombus formation and pressure loss which calls for heart transplantation to prevent early and late stage pathophysiology. We are proposing a novel TCPC smart connector to reduce the pressure and energy loss, thereby improve the hemodynamics properties and unload the single functional ventricle to ensure a longer survival period. A dual propeller micro-pump, which can be sized accordingly to the needs of a particular age group, is developed in conjunction with the TCPC smart connector for boosting the systemic pressure as needed and thereby regaining the normal circulatory physiology in Fontan patients. The pressure augmenting device consists of two micro-propellers, one located in the IVC and the other in the SVC, both connected to the same drive shaft and protected by a flexible stent to anchor the device and prevent interference between rotating blades and surrounding blood vessel wall. The drive shaft is enclosed inside a catheter which is inserted in the vena cava via femoral artery. In order to facilitate device insertion and save space required, the propeller blades are made of smart materials which can be collapsed and deployed as needed.

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