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SCIENCE AND SPECIFICS OF VENTRICULAR ASSIST DEVICES IN PEDIATRICS AND IMPLICATIONS FOR CLINICAL PRACTICE

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Historically, extracorporeal membrane oxygenation (ECMO) provided the option for short-term mechanical support in children with heart failure. Increased experience with existing pediatric Ventricular Assist Devices (VAD's) and the introduction of third-generation VADs for the pediatric age group offer new possibilities for children suffering from end-stage heart failure. Within the past ten years, continuous-flow Left Ventricular Assist Devices (cfLVAD's) have accomplished clinical relevance along with pulsatile-flow Left Ventricular Assist Devices (pfLVAD's) as the standard of clinical care for both destination therapy and bridging patients to heart transplantation. We review the science and specifications of these devices and compared the outcomes of CFVADs and PFVADs to summarize their implications in clinical practice.

A thorough review of the relevant scientific literatures regarding the physiologic and clinical effects of continuous-flow and pulsatile-flow VAD physiology was performed. These effects were analyzed on an organ system basis and include an evaluation of the cardiovascular, hematologic, renal and hepatic. Four pediatric patients (2015-2018) were selected who required circulatory support of different pattern of VAD-flow dynamics at different conditions for better hemodynamics. Each patient required multiple VAD support of different flow pattern for better hemodynamics. Berlin Heart EXCOR, Heart-Ware, PediMag and CentriMag ventricular support systems were used. A retrospective chart review was performed for these patients to assess the effectiveness of continuous and pulsatile flow on different organ systems.

Continuous-flow VAD physiology well tolerated over the long term. It's evident that continuous flow-VAD much helpful on renal function compare to pulsatile flow. No significant changes on other physiological parameters. Given the relative advantages and disadvantages of cfVADs and pfVADs, the ultimate solution may lie in assessing the underlying clinical problem, need of flow specific VAD support and the correct timing-decision making. Future studies examining the hemodynamics, effects on end-organ function and the efficacy of flow-specific VAD support are needed.

Advancements in Extracorporeal membrane oxygenation and ventricular assist devices represent complementary modalities of mechanical circulatory support that can both be used effectively in children with cardiac disease. Flow pattern-specific (cfVAD and pfVAD) supports shows clinical relevance based on the physiological timingly need of the patient.