

Mechanical subpulmonary support in Fontan circulation: A juvenile porcine experimental model

Abstract

Mechanical cavopulmonary assist (CPA) remains challenging for failing Fontan circulation. This study aimed to evaluate the hemodynamic impact of partial CPA using a juvenile porcine model. Six pigs (30 kg) underwent the Fontan procedure using a handmade Y-shaped graft. Total CPA was established by assisting both superior vena cava (SVC) and inferior vena cava (IVC) flow to the pulmonary artery, whereas partial CPA assisted only IVC flow using a centrifugal pump. CPA flow was set to 100%, 50%, or 25% of pre-Fontan cardiac output (CO). Hemodynamics at baseline, after total CPA, and after partial CPA were compared using paired t-tests. Total CPA with 100% CO support increased CO and reduced SVC and IVC pressures compared to baseline (CO, 1.03 vs. 2.36 l/min; SVC pressure, 16.3 vs. 9.5 mmHg; IVC pressure, 17.3 vs. 9.3 mmHg, $P < .05$ for all). Partial CPA with 25% CO support increased CO and decreased IVC pressure, though SVC pressure increased (CO, 1.03 vs. 1.52 l/min; SVC pressure, 16.3 vs. 20.5 mmHg; IVC pressure, 17.3 vs. 11.5 mmHg, $P < .05$ for all). Although total CPA achieved optimal hemodynamics, partial CPA with 25% CO flow was effective, suggesting a feasible, noninvasive solution for patients with failing Fontan physiology.