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Patient-Specific Modeling of Interventricular Hemodynamics in Single Ventricle Physiology[1] VIJAY VEDULA, JEFFREY FEINSTEIN, ALISON MARSDEN, Stanford University — Single ventricle (SV) congenital heart defects, in which babies are born with only functional ventricle, lead to significant morbidity and mortality with over 30% of patients developing heart failure prior to adulthood. Newborns with SV physiology typically undergo three palliative surgeries, in which the SV becomes the systemic pumping chamber. Depending on which ventricle performs the systemic function, patients are classified as having either a single left ventricle (SLV) or a single right ventricle (SRV), with SRV patients at higher risk of failure. As the native right ventricles are not designed to meet systemic demands, they undergo remodeling leading to abnormal hemodynamics. The hemodynamic characteristics of SLVs compared with SRVs is not well established. We present a validated computational framework for performing patient-specific modeling of ventricular flows, and apply it across 6 SV patients (3SLV + 3SRV), comparing hemodynamic conditions between the two subgroups. Simulations are performed with a stabilized finite element method coupled with an immersed boundary method for modeling heart valves. We discuss identification of hemodynamic biomarkers of ventricular remodeling for early risk assessment of failure.

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