Abstract Submitted
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Shape Optimization of the Assisted Bi-directional Glenn surgery for stage-1 single ventricle palliation[1] AEKAANSH VERMA, Stanford University, JESSICA SHANG, University of Rochester, MAHDI ESMAILY-MOGHADAM, Stanford University, KWAI WONG, University of Tennessee, Knoxville, ALISON MARSDEN, Stanford University — Babies born with a single functional ventricle typically undergo three open-heart surgeries starting as neonates. The first of these stages (BT shunt or Norwood) has the highest mortality rates of the three, approaching 30%. Proceeding directly to a stage-2 Glenn surgery has historically demonstrated inadequate pulmonary flow (PF) & high mortality. Recently, the Assisted Bi-directional Glenn (ABG) was proposed as a promising means to achieve a stable physiology by assisting the PF via an 'ejector pump' from the systemic circulation. We present preliminary parametrization and optimization results for the ABG geometry, with the goal of increasing PF. To limit excessive pressure increases in the Superior Vena Cava (SVC), the SVC pressure is included as a constraint. We use 3-D finite element flow simulations coupled with a single ventricle lumped parameter network to evaluate PF & the pressure constraint. We employ a derivative free optimization method- the Surrogate Management Framework, in conjunction with the OpenDIEL framework to simulate multiple simultaneous evaluations. Results show that nozzle diameter is the most important design parameter affecting ABG performance. The application of these results to patient specific situations will be discussed.

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