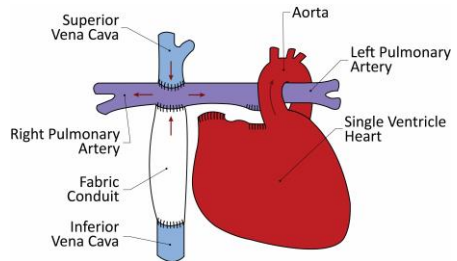


Hemodynamic Analysis of a Cavopulmonary Assist Device for Failing Fontan Circulation

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BACKGROUND

- Patients born with a single functioning heart ventricle require a series of surgeries during the first few years of life, resulting in a Fontan circulation
- Early mortality is low, but these patients prematurely develop circulatory system problems in early adulthood, leading to failing Fontan circulations
- The only treatment for failing Fontan circulation is a heart transplant and a need exists to develop mechanical circulatory support (i.e. cavopulmonary assist devices) to bridge these patients to transplant

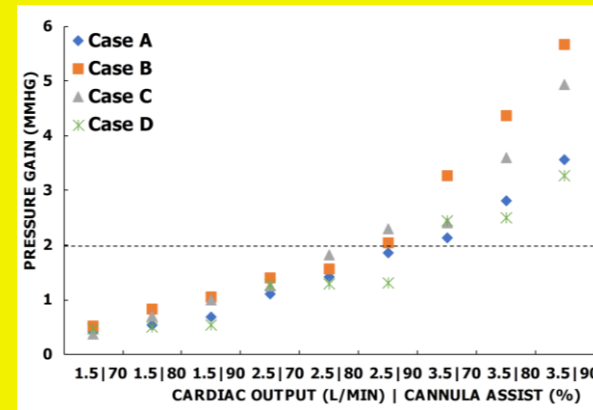
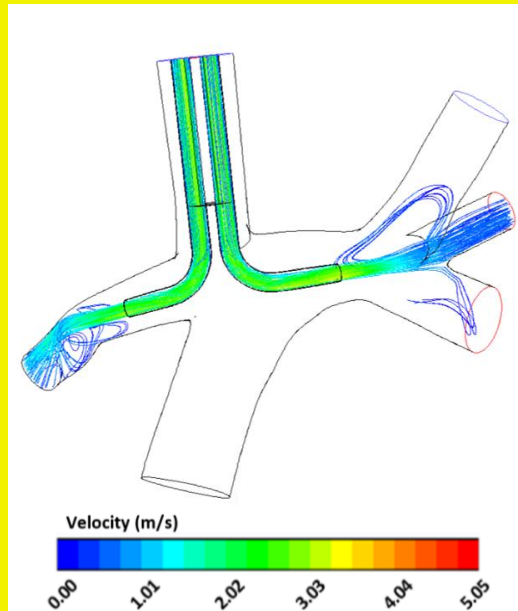


Extracardiac Fontan Circulation

OBJECTIVES

- Design and develop a minimally invasive multi-lumen cannula cavopulmonary assist device
- Quantify device performance *in silico* using computational fluid dynamics simulations
- Construct a mock circulatory loop to test cannula design prototypes *in vitro*

Computational fluid dynamics simulations show potential for multi-lumen cannula device to achieve sufficient **pressure gains for cavopulmonary assist** as a bridge to transplant for failing Fontan patients.

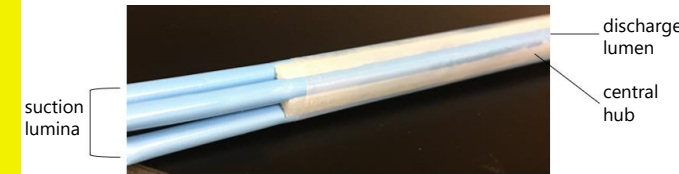


METHODS

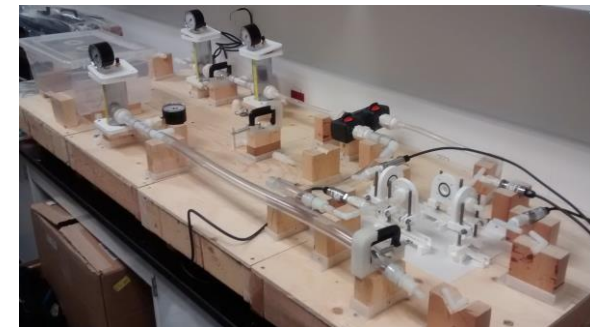
1. Use 3D printed components and commercial catheters to manufacture cannula prototype
2. Perform computational fluid dynamics simulations to assess cannula performance in idealized and patient-specific Fontan pathway geometries
3. 3D print components, including a custom Fontan pathway, to create a mock circulatory loop for cannula prototype testing

RESULTS

- Cannula prototype manufactured and mock circulatory loop constructed
- Baseline pressure and flow measurements made in the mock circulatory loop to prepare for cannula testing



Cannula Prototype



Mock Circulatory Loop

FUTURE WORK

- Cannula prototype to be tested in the mock circulatory loop as a first step towards animal testing in a porcine model of failing Fontan circulation

