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Experimental Assessment of the Hydraulics of a Miniature Axial-Flow Left Ventricular Assist Device[1] P. ALEX SMITH, Univ of Houston / Texas Heart Institute, WILLIAM COHN, Texas Heart Institute, RALPH METCALFE, Univ of Houston — A minimally invasive partial-support left ventricular assist device (LVAD) has been proposed with a flow path from the left atrium to the arterial system to reduce left ventricular stroke work. In LVAD design, peak and average efficiency must be balanced over the operating range to reduce blood trauma. Axial flow pumps have many geometric parameters. Until recently, testing all these parameters was impractical, but modern 3D printing technology enables multi-parameter studies. Following theoretical design, experimental hydraulic evaluation in steady state conditions examines pressure, flow, pressure-flow gradient, efficiency, torque, and axial force as output parameters. Preliminary results suggest that impeller blades and stator vanes with higher inlet angles than recommended by mean line theory (MLT) produce flatter gradients and broader efficiency curves, increasing compatibility with heart physiology. These blades also produce less axial force, which reduces bearing load. However, they require slightly higher torque, which is more demanding of the motor. MLT is a low order, empirical model developed on large pumps. It does not account for the significant viscous losses in small pumps like LVADs. This emphasizes the importance of experimental testing for hydraulic design.

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