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In vitro evaluation of valve hemodynamics in the pediatric pulmonary outflow tract NICOLE SCHIAVONE, CHRIS ELKINS, DOFF MCELHINNEY, JOHN EATON, ALISON MARSDEN, Stanford University — Tetraology of Fallot (ToF) is a congenital heart disease that affects 1 in every 2500 newborns each year and requires surgical repair of the right ventricular outflow tract (RVOT) and subsequent placement of an artificial pulmonary valve. While a wide variety of artificial valves are available, essentially all of them become subject to degradation and dysfunction during the patient's lifetime, which leads to additional interventions. However, there is little understanding about the mechanical function of replacement pulmonary valves and no quantitative placement guidelines to ensure maximum failure-free lifetime. This work aims to experimentally assess the biomechanics of pulmonary valves in realistic RVOT geometries using magnetic resonance velocimetry (MRV), which can measure 3D, three-component phase-averaged velocity fields. The RVOT geometries are constructed using 3D printing, allowing for variation in crucial geometric parameters such as the radius of curvature of the main pulmonary artery (MPA) and the dilation of the artery downstream of the valve. A St. Jude Medical Epic valve is secured inside the RVOT geometry and can be interchanged, allowing for variation of the ratio between valve diameter and MPA diameter. This work will discuss the use of MRV to capture the flow structure in the RVOT and evaluate pulmonary valve performance under different conditions.

Nicole Schiavone
Stanford University

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