

In-Vitro Investigation of the Hemodynamics of a Novel Polymeric Trans-catheter Mitral Valve

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Heart valve disease is a serious problem, especially in Singapore with an increasingly ageing population. When diseased, the dual leaflet mitral valve which lies between the left atrium and the left ventricle might become abnormally thick, displacing itself into the left atrium during systole. The prolapse which results in severe regurgitation causes the heart works harder in order to compensate, ending in eventual heart failure and sudden death if left untreated. Current treatment involves the replacement of the diseased valve with an artificial valve via open heart surgery, which is extremely risky for patients that are too old or ill. In light of this, we have recently developed a polymeric transcatheter mitral valve to target elderly patients unsuitable for open heart surgery. We conducted a particle image velocimetry (PIV) study to evaluate the hemodynamics performance of the valve. Preliminary results suggested that the hemodynamic characteristics are similar to those of existing heart valves. The valve can withstand a working pressure of 120mmHg without detaching from the mitral annulus. The Reynolds shear stress is within the acceptable range of 1500 dynes/cm². Even though the paravalvular leakage is within acceptable range, the leaflet design need to be further optimized in order that the leakage can be further reduced. Percutaneous mitral valve is an emerging area of focus in today's heart valve engineering with the potential to overcome many of the drawbacks observed in current heart valve designs.

Keywords: Heart Valve, Trans-catheter, Mitral valve, Cardiovascular, Interventional cardiology, Hemodynamics