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Investigation of Flow Structures Downstream of SAPIEN 3, CoreValve, and PERIMOUNT Magna Using Particle Image Velocimetry MOHAMMED BARAKAT, CORINNE LENGSFELD, Univsity of Denver, DANNY DVIR, University of Washington, ALI AZADANI, Univsity of Denver —
Transcatheter aortic valves provide superior systolic hemodynamic performance in terms of valvular pressure gradient and effective orifice area compared with equivalent size surgical bioprostheses. However, in depth investigation of the flow field structures is of interest to examine the flow field characteristics and provide experimental evidence necessary for validation of computational models. The goal of this study was to compare flow field characteristics of the three most commonly used transcatheter and surgical valves using phase-locked particle image velocimetry (PIV). 26mm SAPIEN 3, 26mm CoreValve, and 25mm PERIMOUNT Magna were examined in a pulse duplicator with input parameters matching ISO-5840. A 2D PIV system was used to obtain the velocity fields. Flow velocity and shear stress were obtained during the entire cardiac cycle. In-vitro testing showed that mean gradient was lowest for SAPIEN 3, followed by CoreValve and PERIMOUNT Magna. In all the valves, the peak jet velocity and maximum viscous shear stress were 2 m/s and 2 MPa, respectively. In conclusion, PIV was used to investigate flow field downstream of the three bioprostheses. Viscous shear stress was low and consequently shear-induced thrombotic trauma or shear-induced damage to red blood cells is unlikely.

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