

Abstract

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A numerical simulation technique to predicate the turbulent flow through a aortic Jellyfish valve, operating under two volumetric flow rates of 15 l/min and 26 l/min (representing peak systole), is described. The steady incompressible Navier- Stokes equations written in three-dimensional format are solved iteratively using the computational (CFD) code, namely Bio-FL++. The numerical results show that the flow at the edge of the membrane of the valve splits into two nearly symmetric jets with similar phenomenological features. Moreover, the three- dimensional flow simulations indicate the existence of two spiral vortices in the immediate vicinity of the valve ring. Although, these vortices are attenuated rapidly downstream by diffusion, they can have an adverse effect on erythrocytes and active platelets. It is shown also that the elevated shear stresses occur in the vicinity of the leading edge of the occulder valve. In general, the numerical predictions compare very well with the experimental measurements made at various locations downstream of the valve. The locations and the values of maximum velocity and shear stress, as well as width and length of re-circulation regions, are correctly predicted.