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Formation and Evaluation of Vortex Rings from Saddle Shape Nozzle VAHID SADRI, SHELLY SINGH-GRYZBON, ZHENGLUN WEI, AJIT P YOGANATHAN, Georgia Institute of Technology — The mitral valve (MV) is a complex structure with a saddle-shaped annulus, separating the left atrium and left ventricle (LV). During rapid filling of the LV, a three-dimensional asymmetrical vortex ring forms downstream of the annulus. In this study, we investigated the formation mechanism and evolution of vortex rings from saddle-shaped nozzles using direct numerical simulations. A normal human mitral annulus was used to make the saddle-shaped nozzle geometry. The flow was simulated at a jet Reynolds number of 2,000 (based on hydraulic diameter and jet velocity) with jet pulse length-to-hydraulic diameter ratio (L /D_h) ranging from 1 to 6. It was found that the vortex ring from saddle-shaped nozzles has an oscillatory deformation while propagating, which causes the ring to undergo axis-switching. Furthermore, ambient fluid entrainment during vortex ring formation feeds to the main vortex structure, causing circumferential flow that splits the main vortex into smaller portions around the circumference. Additionally, the vortex formation number calculated for low stroke ratio cases.

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