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Three-dimensional Vortical Structures in a Curved Pipe under Fully Developed Pulsatile Inflow CHRISTOPHER COX, MICHAEL W. PLESNIAK, The George Washington University — We numerically investigate spatial and temporal evolution of multiple three-dimensional vortices under a fully developed cardiac physiological (pulsatile) inflow of a Newtonian fluid in a 180 degree curved rigid pipe with circular cross-section, without taper or torsion. We identify vortical structures using vortex identification methods and characterize their evolution throughout the deceleration phase, capturing both Dean- and Lyne-type vortices for which the planes of rotation are different. We track trajectories of Dean-type vortices and find agreement with experimental results. We also show the connection along the axial direction between regions of organized vorticity observed at various cross-sections, which previous 2-D analysis could not provide, and demonstrate that the combined effect of geometry curvature and deceleration produces a strong helical flow that is conducive to the formation of a single pair of Dean-type counter-rotating vortices that is connected to the classical Dean vortex pair near the entrance to the curve. Understanding the formation of these vortical structures is necessary to draw any correlation between the flow and wall shear stress distributions produced under physiological conditions.

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