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Shock-Induced Bubble Collapse in a Vessel: Implications for Vascular Injury in Shockwave Lithotripsy[1] VEDRAN CORALIC, TIM COLONIUS, California Institute of Technology — We numerically investigate the shock-induced collapse (SIC) of a preexisting bubble in a blood vessel and evaluate the potential of such an event to contribute to onset of vascular injury in shockwave lithotripsy (SWL). Previously, we utilized a 3D, high-order accurate, shock- and interface-capturing, multicomponent flow algorithm to carry out a large-scale parametric study of this problem [V. Coralic and T. Colonius, Eur. J. Mech. B-Fluid 40, 64-74 (2013)]. The results indicated that the influence of the blood vessel on the bubble dynamics was negligible and confirmed with experiments that the vessel would freely deform under the forcing imparted by the collapse. As a result, in this study, we perform simulations of the SIC of a preexisting bubble in a free field and couple them to a freely deforming Lagrangian mesh so to characterize the deformations in the fluid surrounding the bubble, which, as our previous results suggest, may be interpreted as the vessel and surrounding tissue. We report the fully 3D and time-dependent Green-Lagrange strains and compare them to the ultimate strains obtained in uniaxial compression/tension tests in tissue. Our findings suggest that the SIC of preexisting bubbles in blood vessels is a viable mechanism by which injury may be initiated in SWL.

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