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Bubble Transport and Splitting in a Symmetric Bifurcation[1] ADNAN QAMAR, JOSEPH BULL, University of Michigan — Transport and splitting of gas bubbles through a geometrically symmetric bifurcation is investigated numerically as a model of cardiovascular gas bubble transport in air embolism and Gas Embolotherapy. An interface capturing Volume of Fluid Method on an Eulerian fixed grid is used to compute the bubble splitting at the symmetric bifurcation. Bubble transport and splitting is investigated for a range of roll angles, capillary numbers, Reynolds numbers and Bond numbers. Results indicate that splitting is observed to be more homogenous at higher capillary numbers and lower roll angles. It is observed that at nonzero roll angles and small bubble lengths, there is a critical value of the capillary number below which the bubbles do not split and are transported entirely into the upper branch. The value of the critical capillary number increases with roll angle and the bubble length. Shear stress distribution at the bifurcation carina increases several folds as the bubble tip reaches the carina. These findings suggest that, in large vessels, gas emboli tend to be transported upward unless flow is unusually strong. In smaller vessels more even splitting of bubbles is predicted. The endothelial cells at a vessel bifurcation would be potentially exposed to higher stress levels, which might induce bioeffects.

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