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Bubble adhesion in a microfluidic model of cardiovascular microbubble sticking JAMES STEPHEN, JOSEPH BULL, The University of Michigan — Motivated by a developmental gas embolotherapy that uses selectively formed gas bubbles for therapy, we investigated bubble sticking in two geometries: planar surfaces and circular cross-section microchannels. It was hypothesized that both surface tension and adhesion forces between the vessel wall and adsorbed molecules on the bubble surface are responsible for bubble sticking in microvessels. The planar geometry experiments demonstrated the effect of serum albumin concentration on surface tension, the tendency for bubbles to resist adhesion to an endothelial cell monolayer, and the apparent role of geometry in bubble adhesion. Microchannels (140 to 800μm in diameter) were constructed from polydimethylsiloxane (PDMS), and bubbles of various volumes were introduced into the fluid-filled channel to occlude the channel's full diameter. Once the bubble was lodged within the channel, the pressures at the inlet and outlet were slowly adjusted, and bubble motion, including the contact angle, was recorded using a microscope and CCD camera. The effects of bubble volume, microchannel diameter, serum albumin concentration, and endothelialized vs. non-endothelialized channel walls were investigated. Noting that surface tension force scales with contact line length and molecular adhesion force scales with contact area, we examined the relative contributions of the two sticking mechanisms. This work is supported by NIH grant EB003541 and Whitaker Foundation grant RG-03-0017.

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