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The Influence of Dome Size, Parent Vessel Angle, and Coil Packing Density on Coil Embolization Treatment in Cerebral Aneurysms[1]
DAVID H. FRAKES, Department of Biological and Health Systems Engineering; School of Electrical, Computer, and Energy Engineering (Arizona State University, Tempe, AZ), APRINDA INDAHLASTARI, JUSTIN RYAN, M. HAITHEM BABIKER, PRIYA NAIR, VARSHA PARTHAS, Department of Biological and Health Systems Engineering (Arizona State University, Tempe, AZ) — Intracranial aneurysms (ICAs) are dilated cerebral blood vessels. Treating ICAs effectively prior rupture is crucial since their association with 45% mortality rate. Embolic coiling is the most effective ICA treatment. Series of embolic coils are deployed into the aneurysm with the intent of reaching a sufficient packing density (PD) to help seal off the ICA from circulation. While coiling is effective, treatment failures have been associated with basilar tip aneurysms (BTAs), perhaps because of their geometry. The aim of this study was to examine the effect of dome size, parent vessel (PV) angle, and PD on intraaneurysmal (IA) velocity, crossneck (CN) flow and low wall shear stress (WSS) area using simulations and experiments in idealized BTA models. IA velocity and CN flow decreased after coiling, while low WSS area increased. With increasing PD, IA velocity and CN flow were further reduced, but low WSS area had a minimal change. Coil PD had the greatest impact on post-treatment flow while dome size had a greater impact than PV angle. Overall, the role of aneurysmal geometries may vary depending on treatment goal and timing e.g., high coil PD may reduce IA velocity more effectively during early aneurysmal growth when the dome size is small.

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