MECHANICAL ENGINEERING

The Department of Mechanical Engineering presents:

The Master's Dissertation Defense of:

Ryan Peck

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Feasibility of MEMS-based hybrid coil-mesh flow diverter for intracranial aneurysms

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Dr. Masaru Rao, Chairperson

Flow diversion devices have generally been successful in the treatment of intracranial aneurysms. However, clinical complications have often been linked to complex and counter-intuitive mechanical responses which arise from the device's braid-based design (e.g. poor wall apposition, excessive foreshortening, etc.). Herein, as a potential response to these issues, we demonstrate the feasibility of a novel microfabricated balloon-deployable flow diverter with finely controlled orthogonal cross-sectional elements which are monolithically integrated into a solid construct. Previous studies have mostly focused on characterizing flow diversion as a result of porosity in highly symmetric devices. By contrast, here we show that similar results can be achieved in more sparse and heterogeneous structures by utilizing basic principles of aerodynamics in micro-scale design (i.e. intentionally designing structural elements to induce drag). Computational and experimental models suggest the potential for such treatment, noting an average intra-aneurysmal velocity reduction of 86% and 88% ± 4% (n=3), respectively and reductions in average wall shear stress of 87% and 88% ± 4% (n=3). Experimental models showed agreement with computational models with the model's predictive metrics for aneurysm occlusion falling within the 95% confidence interval for the experiments.