Biomechanics of Thoracic Aortic Aneurysms

Thoracic aortic aneurysms are defined as a dilation of the aortic wall that can be asymptomatic for many years until they dissect or rupture. Dissection or rupture is associated with a high mortality rate. Surgical replacement is the current treatment standard and is performed when the aortic aneurysm reaches a specified size or growth rate. However, many aortic aneurysms fail before reaching these thresholds and many pass the thresholds without failing. As the aorta is an elastic pressure vessel exposed to flow, we are interested in predicting how the aneurysm will grow, remodel, and fail in response to mechanical stimuli using mouse models of human aneurysmal disease. Data will be presented from our work on biomechanical metrics associated with aneurysms, correlations between mechanical changes and biochemical signaling, growth and remodeling predictions of aneurysm progression, fluid-solid structure interaction modeling of aneurysm biomechanics and failure, and transmural fluid and solid transport as possible contributions to aneurysmal disease.