Background
Soft robots promise new types of endovascular access currently unattainable for traditional surgical robots. This includes novel locomotion through blood vessels as suggested in [1] and endovascular abdominal aortic aneurysm repair (EVAAR) which requires anchoring guidewires. Current methods (Fig. 1) include guidewires with curved ends that provide poor anchoring [2] or balloon anchors which block blood flow [3]. We propose soft, catheter-deployed, continuum spiral actuators inflated with saline to provide safe, compliant anchoring without blocking blood flow (Fig. 1 III). Specifically, we evaluate the traction forces of such spiral actuators as a function of typical intravascular actuation pressures compared to a control of a balloon actuator.

Methods
- Helical actuators (FREEs, [4], Fig. 3) were designed to anchor into a surrogate artery with 12.7 mm ID.
- A 4.76 mm OD, unwrapped latex tube was used as an experimental control of a traditional balloon (Fig. 1 II).
- Traction forces were measured in a water bath using an ElectroForce TestBench with a 20 mm stroke length at a velocity of 0.2 mm/s (1mN accuracy).
- Actuators were inflated to a specified pressure inside the surrogate artery, then pulled apart.
- Pressure was increased by 0.5 atm until actuator burst.

Results
- The results show that our helical actuator was capable of achieving comparable anchoring performance to the control balloon, yet did so with less engaged surface area and without occluding the surrogate artery (Fig. 5).
- Future work will include ex-vivo studies in porcine and human arteries, as well as an expansion into soft robot locomotion in tube-like environments.

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