Aneurysm model

Soft coils are typically viewed as the best design for filling and finishing the aneurysms to achieve a higher packing density and are hypothesized to exert a lower force against the aneurysm wall during deployment. Zhao et al. reported an in vitro pliability test method to assess clinically relevant coil softness and compare these metrics for two commercially available framing and finishing coil products.

A force measurement sensor was affixed onto a side-wall synthetic aneurysm model to continuously measure forces on the aneurysm wall during coil deployment at a fixed delivery rate. A quantitative overall energy metric (average work number or AWN) was calculated from the force-displacement graph representing coil delivery into the aneurysm. Two groups of coils were evaluated: (a) finish coil group (N = 20 ea.): Axium™ Prime Extra Soft coil (ES) and Target™ 360 Nano coil (Nano), and (b) frame coil group (N = 20 ea.): Axium™ Prime FC coil (FC) and Target™ 360 Standard coil (Standard).

(a) In the finish coil group, AWN was measured as: ES (0.53 ± 0.09 gf-cm) and Nano (0.99 ± 0.21 gf-cm). (b) In the frame coil group, AWN was measured as FC (2.54 ± 0.53 gf-cm) and Standard (4.48 ± 0.52 gf-cm). In both groups, Axium Prime coils had statistically lower measures of AWN and therefore higher pliability compared to Target coils ($p < .001$).

The in-vitro pliability test method offers quantitative metrics to assess coil softness during deployment in a clinically relevant aneurysm model [1].

Experimental saccular aneurysm models are necessary for testing novel surgical and endovascular treatment options and devices before they are introduced into clinical practice. Furthermore, experimental models are needed to elucidate the complex aneurysm biology leading to rupture of saccular aneurysms. Several different kinds of experimental models for saccular aneurysms have been established in different species. Many of them, however, require special skills, expensive equipment, or special environments, which limits their widespread use. A simple, robust, and inexpensive experimental model is needed as a standardized tool that can be used in a standardized manner in various institutions. The microsurgical rat abdominal aortic sidewall aneurysm model combines the possibility to study both novel endovascular treatment strategies and the molecular basis of aneurysm biology in a standardized and inexpensive manner. Standardized grafts by means of shape, size, and geometry are harvested from a donor rat's descending thoracic aorta and then transplanted to a syngenic recipient rat. The aneurysms are sutured end-to-side with continuous or interrupted 9-0 nylon sutures to the infrarenal abdominal aorta.

Marcher et al., present step-by-step procedural instructions, information on necessary equipment, and discuss important anatomical and surgical details for successful microsurgical creation of an abdominal aortic sidewall aneurysm in the rat [2].

Rabbit aneurysm model

The rabbit aneurysm model is a commonly used animal model for studying cerebral aneurysms, particularly in the context of evaluating the efficacy of endovascular treatments such as coils and flow diverters. In this model, an aneurysm is surgically created on the common carotid artery of a rabbit,

typically using a combination of an elastase injection and a jugular vein ligation. The resulting aneurysm can then be used to study the aneurysm natural history and aneurysm pathophysiology, as well as to test the effectiveness of various treatment modalities.

1)
Zhao R, Liu J, McComas S, Guo J, Girdhar G. In-vitro pliability assessment of embolization coils for intracranial aneurysm treatment. J Neurol Sci. 2019 Aug 22;406:116432. doi: 10.1016/j.jns.2019.116432. [Epub ahead of print] PubMed PMID: 31629992.
2)
Marbacher S, Marjamaa J, Abdelhameed E, Hernesniemi J, Niemelä M, Frösen J. The Helsinki Rat Microsurgical Sidewall Aneurysm Model. J Vis Exp. 2014 Oct 12;(92). doi: 10.3791/51071. PubMed PMID: 25350840.