Finite Element Modeling of Endovascular Cerebral Aneurysm Treatments Using Flow Diverters

M. Yashar S. Kalani MD PhD; Haithem Babiker; Brian Chong; Michael Robert Levitt MD; Cameron G. McDougall MD; David H. Frakes PhD; Felipe Albuquerque MD

Introduction

We present a novel method based on finite element modeling that incorporates the structure and deployment mechanics of endovascular devices to simulate patient-specific cerebral aneurysm treatments using the pipeline flow diverting device.

Methods

Finite element (FE) computational models of the pipeline embolization device (PED) were modeled using micro CT. Mechanical bench-top measurements of the physical devices were used to validate the computational models. Simulated deployments and fluid dynamics were validated against physical deployments and flow measurements in models. Validation against clinical deployments will be presented.

Results

We obtained excellent agreement between simulated and physical deployments in the urethane models, with less than an 11% difference between post-deployment computational and physical device diameter and cross-sectional area along the stent centerline. Figures 1-3 demonstrate examples of modeled deployments.

Conclusions

Our novel computational model based on finite element modeling can greatly enhance efficacy of flow diverter placement while increasing the safety margin of the procedures.

Learning Objectives

To discuss the utility of finite element modeling in the treatment of cerebral aneurysms using flow diverting stents.

[Default Poster]