

AbstractID: 3714 Title: Planning image-guided endovascular interventions: Models to determine point-specific vessel tortuosity

Purpose: Clinicians often have difficulty passing guidewires and stents during endovascular interventions. Therefore, we are developing models to assess the access path based on stent as well as vessel dimensions.

Method and Materials: Multi-view images of the carotid are acquired during clinical endovascular interventions. The vessel centerlines in the images are indicated and fit with splines. The vessel sizes are measured in the images. The multi-view imaging geometry is determined using the vessel information, and the three-dimensional (3D) vessel centerline is reconstructed using epipolar constraints. The vessel lumen is generated using the measured sizes and a circular cross-section model. Simulated models of devices are created and passed through the 3D patient-specific vessel. The models for this study included (a) a two-segment flexing device centered on the centerline, (b) a four-segment flexing device centered on the centerline, and (c) an unbound six-segment flexing device. The models were placed at all points along the vessel length and the point-specific tortuosity was calculated at each point. The tortuosity was calculated (a) as the ratio of the device length divided by the maximum length of the device inside the vessel, (b) and (c) as the inverse of the cosine of the average angular deviation from a straight device while keeping all segments inside the vessel.

Results: The tortuositities calculated for each model are in good agreement with the apparent tortuosity of the vessel, with tortuosity decreasing from models one through three, reflecting the increased flexibility of the stent model.

Conclusion: These models should provide the basis for more accurate assessment of the passage of devices through access vessels and perhaps be useful in decisions regarding stent lengths and flexibilities.