E-029 RATE AND PREDICTORS OF INTRACRANIAL ANEURYSM COMPLETE OCCLUSION AFTER ENDOVASCULAR EMBOLIZATION WITH SMART COILS

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Background/Objective Although endovascular coiling with SMART coils has been proven to be safe and effective. The rate and predictors of complete occlusion are not well understood. This study aimed to investigate the predictors of complete occlusion with endovascular coiling using SMART coils.

Methods A resorptive analysis of all patients treated with SMART coils at 20 endovascular capable centers. The primary outcome of this study was complete occlusion at the end of procedure defined as Raymond class I. Predictors of complete occlusion were identified using stepwise regression analysis.

Results A total of 907 patients were included in the study of whom 363 (40%) achieved complete occlusion at the end of procedure. History of smoking, location of occlusion, packing density, aneurysm size, wide neck aneurysm, neck size (≥4 vs. <4), stent assisted coiling, balloon-assisted coiling, age, and ruptured aneurysm were associated with complete occlusion in univariate analysis. On multivariate analysis only history of smoking, location of occlusion, aneurysm size, wide neck aneurysm, stent-assisted coiling, female sex and history of hypertension were associated with complete occlusion.

Abstract E-029 Table 1 Multivariate Analysis – Raymond Occlusion (Immediate Post-Procedure), Class I

Multivariate Analysis	OR (95% CI)	P-value
History of Smoking	1.40 (1.07, 1.82)	0.013
Lesion Location		
ICA vs ACA	0.54 (0.40, 0.75)	0.0002
MCA vs ACA	0.72 (0.47, 1.12)	0.14
Other vs ACA	0.88 (0.34, 2.30)	0.79
Posterior Circulation vs ACA	0.72 (0.49, 1.06)	0.099
Aneurysm Size Large (11 to 25 mm) or Giant (> 25 mm)	0.31 (0.20, 0.46)	< 0.0001
Wide-Neck Aneurysm	0.71 (0.54, 0.94)	0.015
Stent-Assisted Coiling	0.68 (0.52, 0.89)	0.0046
Female	0.73 (0.54, 0.99)	0.041
Hypertension	0.76 (0.59, 0.99)	0.040

Conclusion This study identified the rate and predictors of complete occlusion using SMART coils.

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E-030 AN INSTANTANEOUS COMPUTER SIMULATION TOOL FOR SIZING FLOW DIVERTERS

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Introduction Flow diverters (FDs) can be difficult to size during the treatment of cerebral aneurysms (CAs). Complications such as malposition, perforator occlusion, prolapse, and migration are common. The recommended strategy for avoiding these complications is to select a FD size that will appose well to the vessel wall and cover at least 2–3 mm of the parent vessel.[1] Here we present a mathematical model that can be used to appropriately size FDs in real-time. The tool was verified against 154 high-fidelity finite-element (FE) simulations of FD deployments and 17 clinical deployments.

Methods A mathematical model that approximates FDs as mechanical springs was developed. The model uses the FD geometry (braiding angle, diameter, and length) and a direct path on the vessel centerline to predict post-deployment FD length.

Post-deployment FD lengths predicted by the mathematical model were validated against 154 FE simulations of the Pipeline Flex (Medtronic, USA) FD in different CA vessels. The FE simulations are computationally expensive (6–24 hours for one simulation) because they consider the full geometry of the FD, delivery system, and clinical 'push-pull' deployment technique.[2] The mathematical model was also compared to 17 clinical deployments that were reconstructed from flat-detector CT scans of CAs treated with the Pipeline FD.

Results The table 1 below presents comparisons between the mathematical model and the FE and clinical deployments. Figure 1 presents a qualitative comparison of all three deployments.

Abstract E-030 Table 1 Differences in FD length between the mathematical model, FE, and clinical deployments

Mathematical model compared to:	Mean absolute difference(mm)	Standard deviation(mm)	Length measurement uncertainty(mm)
High-Fidelity FE Simulations (n=154)	1.62	1.45	0
Clinical Deployments (n=17)	3.54	1.85	0.37–1.56

Abstract E-030 Figure 1 FD deployment that was (a) reconstructed from clinical data, (b) simulated using high-fidelity FE, and (c) simulated using the mathematical model

Conclusion The mathematical model predicted post-deployment FD lengths that were similar to FE results but at a drastically lower computational cost. Results also showed good agreement in device length between the mathematical model and clinical deployments.

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