



Crescent Sign on Magnetic Resonance Angiography Denotes Incomplete Stent Apposition and Correlates with Diffusion-Weighted Changes in Aneurysm Stent-Coiling

Robert Heller MD; William R. Miele M.D.; Daniel Do-dai MD; Adel M. Malek MD PhD
Cerebrovascular and Endovascular Division, Department of Neurosurgery
Tufts Medical Center and Tufts University School of Medicine

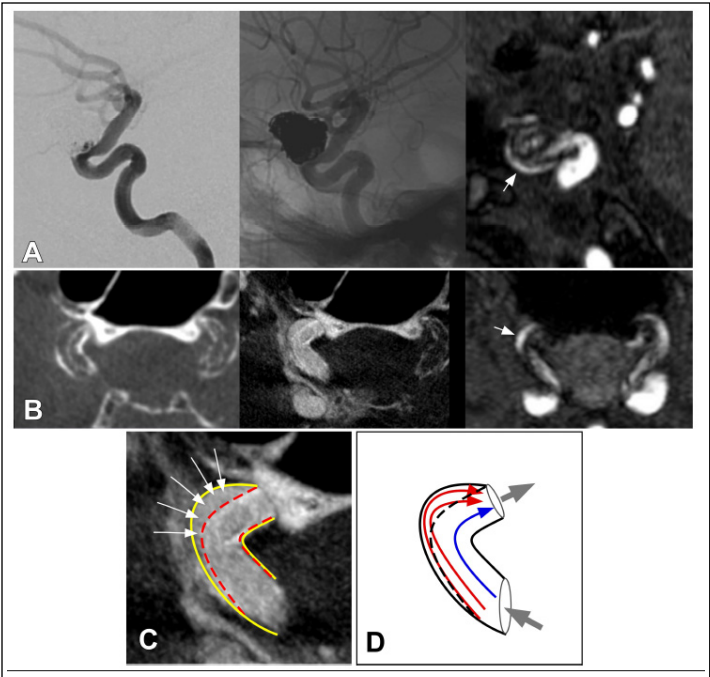


Introduction

Little data is available on how closely stents appose the luminal vessel wall in intracranial aneurysm stent-coiling, and on the effect of incomplete stent apposition on procedural thromboembolic complications.

Methods

Post-procedural 3.0 Tesla (3T) magnetic resonance (MR) diffusion-weighted imaging and time-of-flight angiography were obtained in 58 patients undergoing aneurysm stent-coiling using the Enterprise closed-cell and Neuroform open-cell self-expanding intracranial micro-stents.



Results

A distinctive semi-lunar signal pattern was identified using 3T-MR angiography showing flow outside the confines of the stent-struts in Enterprise but not Neuroform stented patients. This “Crescent Sign” was confirmed to correspond to incomplete stent apposition using high-resolution angiographic flat-panel computed tomography revealing flow ingress and egress out of the isolated luminal wedge.

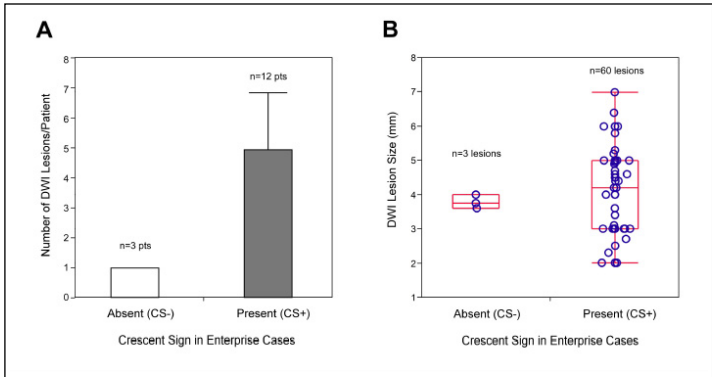
Presence of Crescent sign was seen in 18/33 Enterprise but in 0 of 25 Neuroform cases, and was more likely in stents deployed in the tortuous internal carotid artery ($P=0.034$). The Crescent sign was strongly predictive of ipsilateral post-procedural diffusion-weighted imaging lesions in the entire population ($OR=18$; $95\%CI$, $4.33-74.8$; $P<0.0001$).

In the Enterprise stent subset, ipsilateral diffusion-weighted imaging lesions were detected in 15 of 33 cases (45%); Crescent sign was seen in 12/15 with ipsilateral diffusion-weighted imaging lesions (80%) but only in 6/18 without lesions ($OR=8$; $95\%CI$, $1.61-39.6$; $P=0.006$).

Conclusions

Incomplete stent apposition is detectable on 3T-MR angiography as a Crescent Sign and was found to be highly prevalent in Enterprise closed-cell design aneurysm stent-coiling and associated with peri-procedural ipsilateral diffusion-weighted hyper-intense lesions.

These results identify an association between incomplete stent apposition and thromboembolic complications in intracranial aneurysm stent-coiling.



References

- 1-Ebrahimi N, Claus B, Lee CY, et al : Stent conformity in curved vascular models with simulated aneurysm necks using flat-panel CT: an in vitro study. AJNR Am J Neuroradiol 28:823-829, 2007
- 2-Mocco J, Snyder KV, Albuquerque FC, Bendok BR, Alan SB, Carpenter JS, et al: Treatment of intracranial aneurysms with the Enterprise stent: a multicenter registry. J Neurosurg 110:35-39, 2009
- 3-Piotin M, Blanc R, Spelle L, et al: Stent-assisted coiling of intracranial aneurysms: clinical and angiographic results in 216 consecutive aneurysms. Stroke 41:110-115
- 4-Brooks NP, Turk AS, Niemann DB, Aagaard-Kienitz B, Pulfer K, Cook T: Frequency of thromboembolic events associated with endovascular aneurysm treatment: retrospective case series. J Neurosurg 108:1095-1100, 2008

Learning Objectives

- 1-Be familiar with the importance of stent-wall apposition and its role in thromboembolic events
- 2-Learn to identify incomplete stent apposition using MR angiography and flat-panel angiographic computed tomography
- 3-Learn about the link between incomplete stent apposition and diffusion-weighted imaging changes in stent-mediated aneurysm coiling