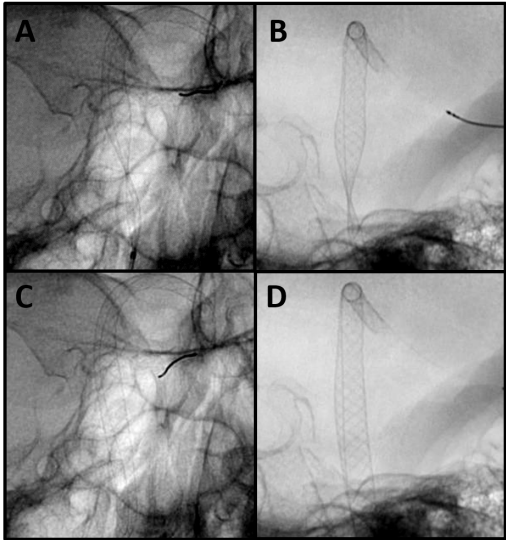


Twisting: Prevalence and Risk Factors of an Under-Reported Intra-Procedural Complication Associated with Pipeline Flow Diversion of Cerebral Aneurysms

Robert W.C. Young BS; Jessica K. Campos MD; Matthew Bender MD; Bowen Jiang MD; David A. Zarrin BS; Chau D. Vo BA; Justin M. Caplan MD; Judy Huang MD; Rafael Jesus Tamargo MD; Li-Mei Lin MD; Geoffrey P. Colby MD, PhD; Alexander L. Coon MD

Figure 1. Intra-procedural PED twisting and subsequent correction during PED deployment for treatment of a mid-basilar artery 15mm dissecting aneurysm.



(A) Native fluoroscopy, anterior-posterior (AP) view, of “Figure-8” twisting in PED during deployment in the basilar artery. (B) Lateral view of “Figure-8” twisting in PED during deployment in the basilar artery. Native fluoroscopy following correction of the PED twist and appropriate vessel wall apposition (C, AP view; D, lateral). Despite remediation, this patient later experienced perforator stroke (mRS 4), which may have been related to incomplete device apposition.

Introduction

Pipeline Embolization Device twisting manifests with the appearance of a “*Figure 8*” in perpendicular planes on DSA. The prevalence of this intra-procedural complication has not been described.

Methods

Case images were reviewed for instances of twisting from a prospectively-maintained, IRB-approved database of cerebral aneurysm patients undergoing flow diversion.

Results

A total of 622 PED-Flex devices were used in 510 procedures on 427 patients, and 19 instances of twisting were observed while treating 16 aneurysms (prevalence 3%, 19/622). Twisting was most common in large, non-saccular aneurysms along the ICA. The average aneurysm size was 17mm (range 4-38 mm), morphology was fusiform or dissecting in 31%, and location was 13 ICA, 1 anterior communicating artery, and 2 mid-basilar artery. Larger diameter and longer devices are predisposed to twisting. Of the twisted devices, 89.5% (17/19) were 4.5mm diameter or larger and 10.5% (2/19) were less than 4.5mm. The average length was 27.5 mm (range 16-35 mm). Of the 19 twisted devices, 13 were remediated and successfully deployed and six were removed (31.6%).

Results Continued

Remediation maneuvers included resheathing and wagging the device. Balloon angioplasty facilitated opening in 3/16 cases and was used for post-processing in 6/19 cases. Procedural success was achieved in 15/16 cases and one procedure was aborted after twisting. One major complication (6%) was observed, a patient with mid-basilar aneurysm treated by PED who experienced perforator stroke (mRS4) that may have been related to incomplete device apposition.

Occlusion outcomes were inferior to the overall population treated with the PED. Follow-up DSA was available for 62.5% (10/16); complete occlusion was observed in 44.4% (4/9) at 6 months, 50% (4/8) at 12 months, and 50% (5/10) at last follow-up.

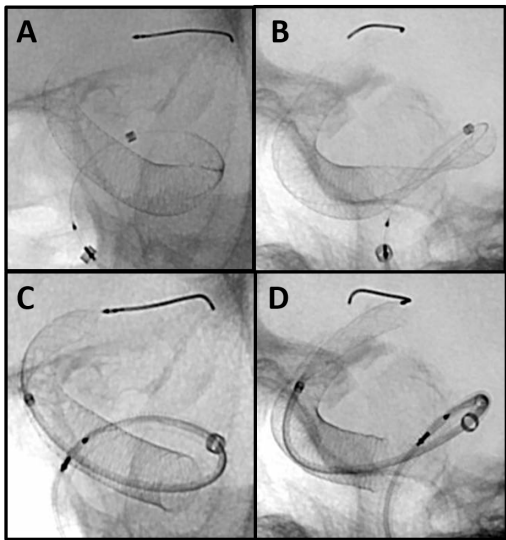
Conclusions

The prevalence of device twisting in a large series of PED-Flex deployments was 3%. Twisting is more common with large diameter devices. PED Twisting may be remediated through a variety of techniques, including re-sheathing, balloon angioplasty, wagging, and exchanging a neutral catheter. PED twisting is more likely to lead to diminished occlusion outcomes.

Learning Objectives

By the conclusion of this session, participants should be able to: (1) Describe the prevalence of and associated risk factors for PED twisting, (2) describe techniques for remediation, and (3) describe clinical outcomes associated with PED twisting.

Figure 2. Intra-procedural PED twisting and subsequent correction during PED deployment for treatment of a left internal carotid artery (ICA) 17mm saccular aneurysm.



(A) Native fluoroscopy, AP view, of “Figure-8” twisting in PED during deployment in the left ICA. (B, lateral) “Figure-8” twisting in PED during deployment in left ICA. Subsequent remediation corrected the twist as shown in C (AP) and D (lateral) native images, appropriate wall apposition was obtained prior to deployment of the second planned PED implantation.