Proposal of a Follow-Up Imaging Strategy Following Pipeline Flow Diversion Treatment of Intracranial Aneurysms

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Disclosure

No disclosures
Introduction

• A standardized follow-up imaging strategy has not yet been established after flow diversion treatment of intracranial aneurysms and there is currently significant heterogeneity with regard to the imaging strategies that are employed for follow-up.

• The aim of this study is to propose a standardizable follow-up imaging strategy based on follow-up imaging data on aneurysms treated with the Pipeline flow diversion.
Methods

• A retrospective review of all patients who underwent treatment for ruptured or unruptured intracranial aneurysms with the Pipeline Embolization Device (PED) was performed, between March 2013 and March 2017, at two major academic institutions in the U.S.

• Exclusion criteria: Aneurysms without any follow-up imaging data available.

• Time to aneurysm occlusion and imaging modality (MRA, CTA, or DSA) used to confirm occlusion, length of last radiographic follow-up as well as aneurysm occlusion status at last follow-up.

• Aneurysms occlusion status was defined as completely occluded (100%), nearly completely occluded (90-100%), or incompletely occluded (<90%) at each radiographic follow-up.

• Primary outcome: Cumulative incidence of aneurysmal occlusion status over time.
Results

• 218 patients underwent treatment for 259 aneurysms with the PED and had undergone ≥1 follow-up imaging study to assess aneurysm occlusion status.

• Mean age of 57.8 (±12.6) years. Most patients (179; 82.1%) were younger than 70 at the time of treatment.

• 235 (90.7%) anterior and 24 posterior (9.3%) circulation aneurysms. 96.1% of aneurysms were unruptured. The median maximal aneurysm diameter was 7.0 mm, and 34.4% aneurysms had a diameter of ≥ 10 mm.

• 231 procedures; 92.2% a single Pipeline flow diverter. There were 12 (5.2%) and 4 (1.7%) thromboembolic and hemorrhagic complications, respectively.

• At last radiographic follow-up, at a median of 8.7 months post pipeline treatment, 200 (77.2%) aneurysms were occluded.

• For incompletely occluded aneurysms (median 14.7 months) or near completely occluded (median 7.7 months), the combined last imaging follow-up was performed at a median of 12.1 months following treatment.
• The cumulative incidence of aneurysm complete occlusion at 6, 12, 18, and 24 months was 38.2%, 77.8%, 84.2%, and 85.1%, respectively.
• 59 (22.8%) aneurysms had an imaging follow-up ≥ 18 months post PED placement. No instances of aneurysm rupture or re-rupture after PED treatment, were observed.
• No differences in the cumulative incidence of aneurysm complete occlusion according to aneurysm location (p=0.39) or aneurysm size (p=0.81) were observed.

• A trend towards a decreased cumulative incidence of aneurysm complete occlusion in patients ≥70 years old was observed (p=0.08).
Proposed follow-up imaging strategy for patients treated with the Pipeline flow diversion

1. Treatment with PED (Start)
   - <70 years old
     - 12 month DSA
     - occluded and not occluded
       - 24 month MRA
         - occluded
           - STOP - no more imaging necessary
         - not occluded
           - not occluded
             - Consider retreatment using alternative endovascular or microsurgical techniques
     - ≥ 70 years old
       - 12 month DSA
         - occluded
           - STOP - no more imaging necessary
         - not occluded
           - not occluded
             - Consider retreatment using alternative endovascular or microsurgical techniques

Note: The diagram outlines a proposed imaging strategy for patients treated with the Pipeline flow diversion. The strategy involves regular imaging at specific time points and considers the outcomes of these examinations to determine further treatment or imaging needs.
We propose initially performing a DSA (at 12 months) followed by an MRA (at 24 months).

The decision to conduct the initial imaging study at a later time point should be weighed against the risk of aneurysm rupture in the latency period.

Presentation with a symptomatic cranial nerve palsy or with a ruptured aneurysm may represent special circumstances under which an earlier (6-month) DSA study is justifiable as well.

For patients $\geq 70$ years old, including a single 12-month DSA may be warranted. If at this point the aneurysm is found to be completely occluded, we believe no further imaging studies are necessary.

For incompletely occluded aneurysms: (our data would suggest that) occlusion is unlikely to occur at this point in this subset of patients. Retreatment with the PED or use of an alternative treatment modality may be considered at this time.
Summary Points

• We propose performing imaging studies 12 months and 24 months post-PED treatment, as a small (but significant) proportion of aneurysms which did not occlude within the first year, occluded over the next year.

• In elder patients (≥70 years), an alternative imaging follow-up imaging regimen can be used.