Repair of Intracranial Vessel Perforation with Onyx-18 Using an Exovascular Retreating Catheter Technique

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Background

• Iatrogenic intraprocedural rupture rates of endovascular treatment range from 2-4% versus open (18-26%) treatment

• Morbidity and mortality, ranging from mild deficits to death (20-50%)
Causes of Iatrogenic intracranial Rupture

- aberrant or difficult anatomy
- stiff wires and catheters
- over-packing aneurysms
- advancing wires/catheters without road-mapping guidance
- aggressive wire/catheter manipulation
- sandblasting during particle embolization.
Universal Recommendation Regarding Treatment Options Include

- Reversal of anticoagulation
- Avoiding hypertension
- Placement of an external ventricular drain (EVD).
- Balloon occlusion
- Parent vessel sacrifice
- Open surgical repair
- In the case on an aneurysmal perforation:
  - sacrifice of the aneurysmal sac with aggressive coil placement
  - use of a second microcatheter
Treatment Options

• We propose a novel treatment option with exovascular occlusion of the perforation using Onyx-18
• Cases are described to illustrate the usefulness of this technique
Onyx Liquid Embolic System

• Approved in 2005 by the US FDA for the presurgical embolization of brain AVMs
• Cohesive polymer of ethylene vinyl alcohol (EVOH) and dimethyl sulfoxide (DMSO)
• Mixed with tantulum particles for visualization
Case #1

- A 55 y.o. female with a previously coiled, unruptured 23 mm right paraclinoid aneurysm was taken to the angiography suite for stent-assisted re-treatment of her residual aneurysm.
- Under GA, the patient was heparinized for a goal ACT >250 seconds
- A 7 F Cook shuttle sheath (Cook, Bloomington, IN) was placed in the right internal carotid artery (ICA)
Case #1

- A Rapid Transit microcatheter (Cordis, Langhorne, PA) was advanced over a 0.018" Glidewire Gold (Terumo, Somerset, NJ) into the right distal middle cerebral artery (MCA).
- Next a 4 mm X 20 mm Neuroform neck remodeling device (Boston Scientific, Natick, MA) was advanced across the neck of the aneurysm, but not deployed.
- Through the second limb of a dual port rotating hemostatic valve, another Rapid Transit microcatheter was advanced over a 0.018" Glidewire Gold into the aneurysm. With the intention of trapping the catheter in the aneurysm with the stent (jailing), deployment of the stent was attempted.
Rapid transit microcatheter in distal MCA
Case #1

- Prior to release of the remodeling device, a control run demonstrated active extravasation from the MCA distal to the stent.
- Heparin was reversed with Protamine followed by rapid deployment of the stent.
- We advanced a 0.010" Echelon microcatheter (ev3, Irvine, CA) over a 0.014" Expedium wire (ev3, Irvine, CA) past the aneurysm to the point of extravasation.
Rapid transit Catheter tip

Delayed extravasation

Dye stain
Injection as echelon 10 microcatheter maneuvered up to and through perforation
Partial and Full Control of Extravasation
After Exovascular control of perforation vessel remain patent
CT Head Showing Onys-18 and Extravasation
Patent vessels and Onyx-18
2 Year Follow up Arteriogram
Case #2

- An 82 year old female presented with symptoms of progressive posterior circulation ischemic symptoms and was found to have a proximal basilar artery (BA) occlusion on MRI/MRA.
• The patient was taken to the endovascular suite for attempted revascularization
• Heparin was administered to achieve an ACT >250 seconds.
• A 6F Envoy guide catheter (Cordis, Miami, FL) was placed in the left vertebral artery (VA).
Initial left VA run showing proximal basilar occlusion
Run distal to proximal occlusion showing top of basilar occlusion with bilateral PCA occlusion
Case #2

- a 0.014" Echelon microcatheter (ev3, Irvine, CA) was advanced over a 0.012" Headliner guidewire (Microvention, Aliso Viejo, CA) into the BA, through the clot, and into the left posterior cerebral artery (PCA).
A microcatheter run demonstrates active extravasation from the left PCA.
Case #2

- Heparin was reversed
- Rapid deployment of Axium coils (ev3, Irvine, CA) were sequentially placed into the subarachnoid space in an attempt to seal the vessel from the outside
- Migration of the coils in the cisternal space disallowed them from occluding the vessel
Onyx & coils in L PCA/
Perimesencephalic cistern

Right image shows left VA injection with persistent basilar occlusion
Basilar stented on left image, f/u left VA run shows patent basilar with filling through left PCA

L PCA open despite onyx no extrav
Post intervention Left CCA showing patent L PCA filling through P. Comm
Follow-up MRI unchanged compared with pre procedure
Conclusion

We propose that injection of Onyx through a retreating catheter can be a viable option to occlude the perforation and maintain parent vessel flow.