Ethanol and Coils AVM Endovascular Bail-Out Procedures for Post-Onyx Failures
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NOTHING TO DISCLOSE

Long-Term Pathologic Follow-Up of Cerebral AVMs Treated by Embolization with Bucrylate.

Dissolution of iBCA On Long-Term Follow-Up.
Rao VR, Mandalam KR, Gupta AK, Kumar S, Joseph S. AJNR 1989; 10: 135 – 141. (F/up 6-20 months post- iBCA embo, had partial recanalizations to complete resorption of iBCA in all patients embolized.)

Repermeation of Partially Embolized Cerebral AVMs: A Clinical, Radiologic, & Histologic Study.

Onyx® LES
• The advantage of time, the power of control.
• Onyx® is a non-adhesive liquid embolic agent used for the pre-surgical embolization of brain Arteriovenous Malformations (AVM).

Onyx
• Is considered as “non-adhesive”, but there are journal reports now of microcatheters still can become “glued” in place and left in. Many non-published cases as well.

• An embolic agent requiring DMSO to polymerize.

• Like its predecessor polymerizing embolic agents iBCA/nBCA, they do not injure the endothelial cell, but are a “space occupying” embolic agent forming a “cast” in the vascular lesion being embolized.

• The endothelial cell senses the decreased O2 tension in the “filled” vessel and sends out Chemotactic Cellular Factor (macrophage migration to carry out embolic debris; “recanalization” results) and Angiogenesis Factor (new blood vessel formation to re-vascularize the occluded vessels; “neovascular stimulation”).

Histopathologic Changes in Brain AVMs after Embolization Using Onyx or nBCA. Laboratory Investigation. Natarajan SK, Born D, Ghodke B, Britz GW, Sekhar LN. J Neurosurg 2009; 111: 105 – 113. (11.8% recanalization rate in resected specimens, no time frame given at time of resection)

Higashida RT. Embolization of (Brain) AVMs with Onyx: Clinico Pathologic Experience in 23 Patients. Neurosurgery 2001 (Comment); 48: 995. (Onyx late recanalizations have been described in brain AVMs.)

Higashida RT. Embolization of (Brain) AVMs with Onyx: The Histologic tissue Changes, Tissue Inflammatory Response, Fluoroscopy Issues, & Endovascular Issues With Its Use. Molly Meeks MD. University of Arkansas, Little Rock, Medical Center. Veith Symposium Nov 2014 Lecture. (All resected head & neck AVMs 1 year post-Onyx embo, recanalizations are routinely seen histologically in the resected specimens. High fluoro doses.)
Absolute Ethanol
- Non-polymerizing most powerful liquid sclerosant embolic agent
- Precipitates the protoplasm of the endothelial cells and causes fractures to the level of the internal elastic lamina of the vessel wall.
- Progressive thrombosis due to platelet aggregation upon the denuded vascular wall
- With the endothelial cell destruction, “Neovascular Stimulation” & “Recanalization” are noticeably absent
- Permanence of the vascular occlusion is now possible, therefore cures are a potential outcome.

Onyx
40 year old female with massive scalp AVM. Four Onyx embo sessions. No more endovascular access for Onyx deposition.
Cavernous RICA catheterization dissection requiring stenting. Microcatheter “Onyxed” into the RICA permanently. AVM remaining without cure.
Yakes Type IIIb AVM

41 year old male with massive right scalp AVM causing pain and pulsatile tinnitus. Patient had severe coagulopathy due alcoholic cirrhosis.
12 year old female with massive Rt Face, Scalp, and Maxillary AVM. Multiple Onyx embos with massive Onyx deposition in the Rt temporalis, facial, and maxillary areas.

No further ability to inject any more Onyx. Pt is now blind in her Rt eye, and still has unabated massive hemorrhages from the nasal & oral cavities.

Referred from London for definitive ETOH endovascular treatment due to her unremitting hemorrhages. After 13 ETOH direct puncture procedures, her bleeding has significantly diminished but continues. A partial resection of the Onyx has been performed. Once more of the AVM is treated, further Onyx resections are contemplated.
Yakes Type IIIb AVM
7 year old female with multiple AVMs of the Rt face, Rt maxilla, Rt mandible, & Rt Temporalis. Multiple episodes right oral gingival hemorrhages. Loose molars right mandible. Steadily worsening condition. Seen at UCSF and Stanford and both recommended Rt hemi-facial and Rt orbital resection.
40 year old female with massive Rt. abd/pelvic/thigh AVM s/p numerous Onyx embol. Complications required Rt. high thigh amputation. The post-op wound would not heal due to significant venous hypertension secondary to massive residual AVM. The skin necrosed leaving an open wound from the Rt. pelvis to Rt. buttock area.

Patient then suffered from repeated sepsis and hemorrhages requiring multiple hospitalizations for IV antibiotic Rx, wound care, and requiring 5-10 unit transfusions monthly.

Patient eventually referred for definitive ethanol endovascular Rx due to unremitting problems of the above issues.
Since the end of 2 years of multiple ethanol and coil embolization treatments, the last 5 years the patient has remained stable and free from the unremitting infections and hemorrhages.

Yakes Type IIa AVM
47 year old male with severe right buttock and thigh pain syndrome and weakness in right lower extremity
Massive Rt pelvis and thigh AVM