Review of Treatment Techniques for Various Presentations of AVMs

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Disclosure

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I have the following potential conflicts of interest to report:

☐ Consulting
☐ Employment in industry
☐ Stockholder of a healthcare company
☐ Owner of a healthcare company
☒ Other(s)

☐ I do not have any potential conflict of interest
VM Treatment

• Goals need to be established with every patient
• Most VMs will need multiple treatments
• Benefits and risks must be discussed
• Treatment usually is palliative
• Multidisciplinary approach leads to best outcomes
AVM Treatment

Nidus ni·dus ˈnī-dəs, noun
1: a nest or breeding place; especially: a place or substance in an animal or plant where bacteria or other organisms lodge and multiply
2: a place where something originates, develops, or is located

https://www.merriam-webster.com/dictionary/nidus
Treatment

http://statebystategardening.com/state.php/mi/print/douse_the_flames/
Treatment

http://statebystategardening.com/state.php/mi/print/douse_the_flames/
https://bugguide.net/node/view/274644/bgpage
Treatment

• Eliminate the nidus
• No ideal embolic agent
• Particles are not precise
• Liquid agents
  – Absolute ethanol – intrinsic toxicity, can’t see
  – Acrylic adhesive
  – Ethylene vinyl alcohol copolymer (Onyx®) – precipitates rather than adhesive agent
  – Coils (detachable) and/or plugs
• Only the complete eradication offers the potential for optimal treatment.

• Proximal arterial embolic occlusion or surgical ligation of arterial feeding vessels alone can have disastrous consequences.
Absolute Alcohol or EtOH

**Advantages**
- Most effective sclerosant
- Available
- Inexpensive
- “Easy to Handle”

**Disadvantages**
- Painful
- Marked tissue swelling
- Cutaneous necrosis
- Skin Blistering
- Nerve Palsy
- Respiratory depression
- Cardiac Arrhythmias
- Seizures
- Rhabdomyolysis
- Hypoglycemia
- Hemoglobinuria
- Renal damage
Sclerotherapy and AVMs

1. After access is achieved, it is preceded by contrast agent injection into the vascular distribution to be embolized noting volume and flow rate.

2. Ethanol is delivered in small 0.5- to 1-mL aliquots.
   - Allowing time for endothelial damage to become evident, repeat angiography is performed 5 to 10 minutes. Repeat prn. 1 mL/kg max dose.

3. Sotradecol has NOT been shown to be as effective in high flow lesions.
Ethylene Vinyl Alcohol (Onyx®)

- Liquid embolic copolymer developed by eV3, now Covidien.
- Solute is Dimethyl-Sulfoxide (DMSO)
- Onyx 18 (6% EVOH)
- Onyx 34 (8% EVOH)
- Micronized tantulum powder (radioopacity)
- FDA approved for brain saccular aneurysms not amenable for surgery in 2007

Liquid Embolics

**Ethylene vinyl alcohol copolymer (Onyx® Liquid Embolic System)**
- nonadhesive liquid embolic
- suspended micronized tantalum powder for radiographic visualization
- more predictable fixation
- can contour to the vessel in question
- very radiopaque
- much less likely to fixate the delivery catheter to the vessel wall

**Cyanoacrylates (nBCA)**
- adhesive glues. Mix w/ contrast/lipiodol
- polymerize when exposed to anions (H20)
- acute fibrotic inflammatory foreign body granulomatous reaction progressing over approximately 1 month
- plagued by recanalization after Rx
- embolization of glue into the lungs via the shunt
- inadvertent gluing of the catheter to the vessel
- masses of cyanoacrylate within AVMs can cause muscular dysfunction, become superinfected, and erode or extrude into adjacent tissue
Case 1

15 yo female with pulsatile mass on plantar surface of foot causing pain with ambulation.
Occlusive devices...

• Coils and plugs
• Proximal arterial embolic occlusion or surgical ligation of arterial feeding vessels alone can have disastrous consequences
• But, they are still in the tool box
Case 2

62 year old male with left hip pain for greater than one year.

No significant PMHx
Retrospective review of 14 patients, 13 of which underwent transvenous approach of AVMs in an extremity or pelvis.
- Seven had percutaneous approach and eight had concurrent transarterial approach.
- 36% had a complete response.
Case 3

59-year-old male with right renal arteriovenous malformation resulting in high output cardiac failure
Other Retrograde Methods

- Transvenous occlusion-assisted
  - Balloon or manual compression with ethanol sclerotherapy or nBCA
  - Plug assisted with ethylene vinyl copolymer and detachable tip microcatheter, “Push-Through Technique”

Case 4

- **HPI** - 56 YO F who initially presented with RUE ischemia due to extensive AVM to Vascular Surgery. A subclavian to brachial artery bypass was performed.
- Right arm soft tissue wound was noticed and due to lack of insurance, a one-time, *pro bono*, embolization was performed.
- After about 7 months, insurance was obtained.
- Goal at treating AVM was wound healing and bleeding control. Ultimately 14 embolizations/sclerotherapy performed.
- Follow up in clinics for wound dressing changes.
Next Steps

• Patient was stabilized in Hybrid OR...Vascular Surgery was called first

• Vascular Surgery respectfully called me and I performed alcohol sclerotherapy

• Patient was re-presented in Multidisciplinary Limb Restoration Conference

• Forequarter amputation performed
“Typical treatments include laser therapy, sclerotherapy and surgery. Most of our families only need reassurance; we are here for that as well.”
Take Home Points

• Attack the nidus in AVMs
• Awareness of different treatment options and their associated risks
• Establish realistic expectations
• Practically speaking, for better patient outcomes, longitudinal care is essential
• Know your limitations
• Multidisciplinary approach is optimal
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