Use of polymerizing agents in the endovascular treatment of AVMs

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AVM TREATMENT OPTIONS

SURGERY FOR AVMs

• Mainly suitable for localized, completely resectable lesions; ligating feeders ineffective or worse
• “De-Bulking” procedures may be helpful in extremely large lesions, but patient selection is critical
• Need detailed pre-op imaging studies to evaluate true extent of lesion
• Must be prepared for blood loss – tourniquets, cell saver, possible pre or intra-op embolization
• Significant likelihood of recurrence (many patients we see have surgical scars)

EMBOLIZATION FOR AVMs

• Ideal embolic agent would:
  – Obliterate nidus
  – Be permanent
  – Be controllable
  – Be non-toxic including long term

Unfortunately, this agent does not exist, at least not yet...

• What we have to choose from
  – Particles/microspheres
  – Ethanol and other sclerosants
  – Liquid adhesives (NBCA)
  – Other liquid agents (Onyx, Ethibloc, etc.)

I am not an anti-alcohol crusader
Ethanol intravascular vs direct injection; nidus isolated with nBCA, then EtOH used by direct puncture

Just be aware of the risks...

ACRYLIC ADHESIVES – nBCA (“Glue”)

- ADVANTAGES
  - Permanent (theoretically)
  - Minimal tissue toxicity
  - In use since 1965 (>1500 cases in literature) with no reported adverse long term effects
  - Low viscosity
  - Rapid vessel occlusion; useful in high flow lesions
  - Can be made radiopaque without impairing occlusive properties

- DISADVANTAGES
  - Significant learning curve
  - Requires strict maintenance of non-ionic environment
  - Occludes catheter after each deposition
  - Flow pattern not completely predictable; dynamic process
  - Expensive

FDA Approved 9/00

NBCA Preparation

- Typical mixture – equal vol. (0.5cc) NBCA and Ethiodol oily contrast
- Tantalum powder optional – Ethiodol provides adequate radiopacity and slows polymerization
- Small volumes used in each deposition (0.2 – 0.5cc)
- Scrupulous attention to maintaining non-ionic environment (D5W flush, separate table, new gloves)

“Approximate” is the key word here...

- Use only a few dilutions with ethiodol (1:1, 2:1, 3:1) – get used to it’s behavior
- Don’t make each case an experiment
- Skip the tantalum powder

NBCA Delivery Technique

- Through coaxial microcatheter
- Through small caliber needle
GLUE DELIVERY TECHNIQUES

- Use arterial flow to your advantage, allow flow to carry agent distally
- "Continuous column" technique – the ideal, but doesn't usually work well in real world (avg. volume 1 – 2 cc); only one deposition per microcatheter
- "Push" technique – does not create cast, but ensures distal penetration (avg. volume 0.2 – 0.6 cc, pushed with D5W); may get multiple depositions per microcatheter
- A small amount of glue goes a long way

35 y o female with pelvic pain due to high flow AVM

One deposition of 0.3cc nBCA

"Direct Stick" approach used increasingly – nBCA through micropuncture needle

Get directly to nidus Normal vessels preserved Use roadmap for targeting

28 y o male with pain and lower GI bleeding

Dominant draining vein – venous approach

Houdart, Yakes – Classification based on nidus architecture
HIGH FLOW DIGITAL AVM – AMONG THE MOST DIFFICULT

PRUNE AWAY FEEDERS FROM NEEDED ARTERIAL SUPPLY TO DIGIT

Onyx

Onyx Issues

- Radiologic density tends to obscure field for subsequent depositions or procedures
- Time consuming
- DMSO can cause vasospasm
- Requires sig preparation time
- Expensive
- Sparking with electrocautery in OR
- Smell

Onyx (non-medical) issues

- Status for non-neuro use in U.S. remains unclear – widely used outside US
- Definitely off-label
- Possible medicolegal implications if cx
- Question of billing under CMS rules

3,015 AVM (HF) Patients Treated at Lenox Hill/NYU, 1980-2016

Overall: 85% cured, asymptomatic, or significantly improved
NYU/Lenox Hill Experience 1980-2016

- 3015 pts treated over past 36 years
- 0 deaths
- 3 amputations, not direct result of embolization (1 digit, 1 BKA, 1 forearm after attempted resection)

SUMMARY

- ERADICATION OF NIDUS IS GOAL
- LIQUID AGENTS ARE BEST – GLUE, POLYMERS, ETHANOL (VERY EFFECTIVE BUT HIGHEST RISK WHEN USED INTRA-ARTERIALLY)
- NBCA IS EFFECTIVE BUT OFTEN DOES NOT PRODUCE COMPLETE CAST
- ONYX TAKES LONGER, MORE EXPENSIVE, DENSITY CAN OBSCURE ANATOMY
- VENOUS APPROACH CAN BE HIGHLY EFFECTIVE WHEN THERE IS DOMINANT OUTFLOW VEIN
- RESULTS MUST ALWAYS BE JUDGED OVER THE LONG TERM