Aortopulmonary Collaterals and Coronary Artery Fistulas

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Disclosure Information

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As a faculty member for this program, I disclose the following relationships with industry:

(GRS): Grant/Research Support (C): Consultant (SB): Speaker’s Bureau
(MSH): Major Stock Holder (AB): Advisory Board (E): Employment
(O): Other Financial or Material Support

pfm Medical: C
Atrium Medical: C
Neurosigma Vascular: AB
NIH Challenge Grant, AHA Innovative Research Grant
Case 1: 4 year old with a loud Continuous murmur

• Mild CHF
• Thrill
• 4/6 high pitch
• continuous murmur at LLSB
• Differential Dx?
• Treatment options
Approach:
• Define all coronaries
  • Selective
  • Balloon
• Define CAF
• Distal stenosis
• Occlusion Strategies
  • Coaxial
  • Retrograde
• Coil VS device
CASE 1: CAF SELECTIVES
CASE 1: CAF WIRE RAIL-retrogade
CASE 1: CAF Antegradeguide cath
CASE 1: CAF
POST-angio
CASE 1: CAF
OUTLINE: The War with Collaterals

• When to coil?
  • Good/Bad guys
  • In between

• How to coil?
  • Carpet bombing
  • Surgical strike

• Weapons
Case 2: TOF-PA-MAPCAs
TOF - PA - MAPCAs
Case 2: TOF-PA-MAPCAs
TOF-PA-MAPCAs
TOF-PA-MAPCAs: Defining Collaterals

• Selective Injections/Measurements
  • Measure Pressures everywhere
  • Microcatheters and Radi-Wire

• Define Overlap (True PAs vs MAPCAs)
  • Balloon Occlusion of MAPCAs
    • 4Fr Wedge, Tyshaq Balloon

• Simultaneous Injection in True PAs
TOF/PA – MAPCAs – Cath Reports
TOF/PA – MAPCAs – Cath Reports
MRI in PA/VSD MAPCAs?
TOF-PA-MAPCAs
MRI Compatibility: MReye (Inconel) Coils

- Strong radial force: same as stainless steel coil
- Available in .025”, .035”, .038”
- MR conditional up to 3T
  - No ferromagnetic properties up to 3T
  - Can be immediately scanned
- Excellent for high flow applications
- Creates occlusion individually or can be used with softer platinum coils as a scaffold.
Detachable Coils: Flipper Coil

- Cost effective
- Effective – high radial force
- Easily delivered (glide cath)
- Long synthetic fibers
- MRI compatible Inconel
PA-VSD with Collaterals
Detachable Coils: IR and NeuroIR

Axiom

Interlock

GDC
Detachable Coils: Interlock Fibered Detachable Coils
Microcatheters

• **Mira-Flex High Flow (2.8Fr)**
  - 0.025” ID designed for both coil and particle delivery. Wire guides up to 0.021” OD
  - Consistent 2.8Fr size from hub to tip allows for distal access and use through 0.038” catheter systems

• **Mira-Flex (2.5Fr)**
  - Coil compatibility and deliverability thanks to the 0.021” ID
  - Wire guides up to 0.018” OD
  - Compatible with 0.035” or 0.038” catheter systems
Assessment of MAPCA Anatomy/Pressure: Use of Microcatheters
Assessment of MAPCA Anatomy/Pressure: Use of Microcatheters
Case 3: Single Ventricle
Case 3: Single Ventricle Collateral
Case 3: Single Ventricle Collateral
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Micro-Particles and Liquid Embolics

• PVA (poly-vinyl alcohol) or Ivalon
  • Nonabsorbable, compressible sponge (Portsmann plug)
  • 300-700um particle suspensions (Cook and Target)

• Gelfoam
  • Bioabsorbable gelatin sponge
  • Cut into strips and inject or use as a powder

• Acrylic microspheres
  • Embospheres – gelatin coated acrylic spheres
  • Avoid clumping in microcatheters

• Glue and Liquid Embolics
  • Superglue – n-BCA or Truefill (Cordis) - AVMs
  • Non-glue based liquid embolics Onyx - aneururmys
Micro-Particles: EmboSpheres

• BioSphere Medical – tumors & AVMs (FDA 2000)
• EmboSphere (hydrophilic beads – acrylic polymer cross linked with gelatin)
• EmboGold
  • Hyrophilic beads with improved visibility (OFF MARKET)
• QuadraSphere – expanding spheres
  • coming soon
• Terumo – bead block – compressible
• Boston Scientific – Contour PVA
Embolization-Particles: EmboSpheres

• Come Premixed
• Dilute 1:1 with Contrast
• Mix thoroughly (with stopcock)
• Inject very slowly
• Size beads to size of vessel
  • 900 um for AP collaterals
  • Do not allow particles to reflux
• Flush catheter
• Keep particles separate
• Ask IR docs for help
Case 3: Single Ventricle Collateral
Case 3: Single Ventricle Collateral
Case 3: Single Ventricle Collateral
Case 4: Single Ventricle Collaterals- PV Wedge Injections
Case 4: Single Ventricle Collaterals
Reconnection of True PAs
Case 4: Single Ventricle Collaterals
Reconnection of True PAs
Case 4: Final Result????
Single Ventricle Collaterals: Final Result
Embolization Strategies

- Vessel Sizing / Vessel Anatomy
- Collateral Vessels / Collateral Flows
- High Flow / Low Flow
- How Much Is Enough

Determines

- What Embolics?
  - Coil vs. Particles
- What Coils?
  - Inconel vs. Platinum
- What Technique?
  - Anchor vs. Scaffold
- What Sizes?
  - Diameter & Length
- How Many Coils?
Cross-sectional Occlusion

Cross-Sectional Occlusion Equals Permanent Occlusion.

INADEQUATE PACKING

DENSE PACKING

Effects of Not Creating an Initial Dense Cross-Sectional Occlusion

5 YRS POST EMBOL
Critical in determining appropriate coil length and most importantly, diameter.

Recommended that coil diameter is upsized 20% to the vessel diameter.

Recommended that coil is long enough to tightly pack vessel, without obstructing essential collateral vessels or protruding into parent vessel.

Vessel anatomy determines coil type. (Tapered vs. Non-Tapered vessels)
Coaxial Technique

Coaxial Technique To Prevent Coil Elongation

Guide catheter provides “support” or “purchase” for delivery of coil into a densely packed coil mass.

Diagram showing the coaxial technique with a guide catheter and a micro catheter.
Scaffold Technique

Scaffold Technique

Guide Catheter 7 Fr
Inner Catheter 5 Fr
High Radial Force Coil

High Radial Force Coil Deployed (Scaffold)
Weaving

Soft Coil

Soft Coil Deployed Cross Section Occlusion Completed
Aortopulmonary Collaterals and Coronary Artery Fistulas

• Know your weapons
  • Microcoils, pushables, detachables
  • Get experience with embolic particles

• Techniques
  • Scaffolding
  • “PDA style”
  • Packing density

• Define collaterals & True PAs
• Define the cause of cyanosis