The toolbox for embolization therapy: Liquid embolics, coils, plugs, particles

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- C Del Giudice, O Pellerin, G Amouyal

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Plugs (endovascular clamp)

- Tool to occlude vessels

- Size
  - Big ....
  - Small

- Delivery system
  - Large sheath
  - 5 F catheter
  - Micro catheters
Amplatzer Vascular Plug: AVP
AVP plugs (St Jude)
AVP I

<table>
<thead>
<tr>
<th>AMPLATZER Vascular Plug Diameter</th>
<th>Device Length</th>
<th>Sheath Minimum Requirements</th>
<th>Minimum Internal Diameter</th>
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<tbody>
<tr>
<td>4 mm</td>
<td>7 mm</td>
<td>4 F</td>
<td>0.056&quot;</td>
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<tr>
<td>6 mm</td>
<td>7 mm</td>
<td>4 F</td>
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<td>8 mm</td>
<td>7 mm</td>
<td>4 F</td>
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<td>8 mm</td>
<td>6 F</td>
<td>0.087&quot;</td>
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<tr>
<td>16 mm</td>
<td>8 mm</td>
<td>6 F</td>
<td>0.087&quot;</td>
</tr>
</tbody>
</table>

30 to 50 % oversizing

A short device,
AVP II

A **long** device once in place

<table>
<thead>
<tr>
<th>AMPLATZER Vascular Plug II Diameter (mm)</th>
<th>Pre-Implanted Device Length (mm)</th>
<th>Sheath Minimum Size</th>
<th>Minimum ID Required (inches)</th>
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</thead>
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<tr>
<td>22</td>
<td>18</td>
<td>7 Fr</td>
<td>0.098&quot;</td>
</tr>
</tbody>
</table>
AVP IV (compatible with .038 diagnostic catheters)
Not all 5 or 4 F catheters are recommended
Avoid too soft catheters
AVP delivery (anticlockwise rotation)
Choose the plug (1)

- **Size the target vessel (CTA, QCA, QVA)**
- **Oversize**
  - Artery 20 - 50 %
  - Vein 30 - 100 %
- **Choose the sheath according to the plug**
  - For a 8 mm AVP I need a 5 F (0,056 inch)
  - For a 16 mm AVP II need a 6 F (0,086 inch)
Plug in the left sub clavian
Even smaller ....?

- Plug that you can insert through a micro-catheter
  - Small vessel occlusion
  - Travel through tortuous arteries
  - Immediate occlusion
  - No re-canalisation
A Medtronic device

**MVP System** | **Target Vessels** | **MVP Length Unconstrained** | **MVP Width Unconstrained** | **Microcatheter ID Recommended** | **Microcatheter Length Recommended**
--- | --- | --- | --- | --- | ---
MVP-3 | 1.5 – 3.0mm | 12mm | 5.3mm | 0.021” | <150cm
MVP-5 | 3.0 – 5.0mm | 12mm | 6.5mm | 0.027” | <150cm

Note: Larger sizes in development
• Microcatheter deliverable
• Re-sheathable
• Electric detachment
  …mechanical

• Target vessels 1.5 - 5.0 mm diameter
Patients

- 4-2013 to 9-2013, all consecutive patients
  - Y 90
  - IA port placement
- 14 consecutive patients, 16 plugs (2 p with 2 arteries)
  - right gastric artery (12)
  - pancreatico-duodenal artery (3)
  - segment IV artery (blood flow redistribution) (1),
- Target artery diameter 2.1 ± 0.5 mm
- Single MVP / artery.
Results

- Immediate occlusion 100 %
- Relocation (re sheath) in 30 %
- Release time: 38 s.
- In one case need for a microcoil because the plug was slightly too distal
Clinical Case #1 Y-90 Mapping
Pancreatic Branch Artery Embolization

Geert Maleux, MD PhD – University Hospitals Leuven, Belgium
Superselective embolization through microcatheter

Pre - Embolization

Post - Embolization
Coils (endovascular clamp)

- Stainless Steel - platinum coils
  - occlusion
    - thrombus
    - Metal
- Enhanced thrombogenicity
  - Hydrogel
  - Fibered coils
Classification

- .035 /.018
- Pushable / detachable
- soft / rigid
- 2 D / 3 D
- Metal: nitinol / stainless steel ...
- Fibered / non fibered
Various types of coils
Hydrocoils

Conventional .010 Coil

Before Hydration

After Hydration
Micro-particles

- Small beads to occlude capillaries
- Calibrated
- Non calibrated (PVA particles)
- Drug Eluting Beads (DEB)
Calibrated particules
Kill the tumour....
**Embosphere Microspheres**

In a Pre-Filled Syringe

**Preparation and Administration**

1. **Match the total volume in the 20 mL syringe with the same volume of undiluted contrast, which will result in a 50% Embosphere microsphere and 50% contrast solution.**

2. **Remove all air from the syringe.**

3. **Gently invert the 20 mL syringe several times to evenly mix the Embosphere microspheres/contrast solution.**

4. **Wait several minutes to allow the Embosphere microspheres to achieve suspension.**

5. **Attach the 20 mL syringe to the top port of the 3-way stopcock.**

6. **Attach a 1 mL or 3 mL injection syringe to the second port.**

7. **Close the stopcock to the remaining port and attach a delivery catheter at this time if desired.**

8. **Slowly and gently aspirate the Embosphere microspheres/contrast solution into the injection syringe.**

**Note:**

- Vigorous syringe-to-syringe transfer will not speed suspension.
- It may create microbubbles which will delay homogeneous suspension.

9. **Close the stopcock to the 20 mL syringe.**

10. **Using fluoroscopic guidance, inject the Embosphere microspheres/contrast solution, using a slow, pulsatile injection.**

11. **If the Embosphere microspheres/contrast solution requires re-suspension, gently invert the 20 mL syringe several times.**

12. **Upon completion of the procedure, maintain gentle suction during catheter removal to prevent Embosphere microspheres from exiting the catheter lumen.**

**Please refer to the Embosphere-Microspheres Instructions for Use for more information.**
Liquid embolics

- Occlude the vessel
- Occlude the nidus
- Or Both
- Flow directed
Two main agents

- Glue (NBCA)
- EVOH based (Onyx TM)
Onyx Precipitate

External Surface

Onyx Precipitate

Internal Surface
Instructions For Use

1. Shake Onyx at least 20 min on a specific Vortex

2. Flush contrast from microcatheter with saline

3. Fill the white 1 ml syringe with Onyx through an 18 or 20 gauge needle
Directions for use

4. Filling catheter deadspace

- Aspirate approximatively 0.5 ml of DMSO into the yellow 1 ml syringe

- Inject DMSO into delivery catheter in sufficient volume to fill catheter deadspace

- As soon as the DMSO has been injected, remove the DMSO syringe, hold the catheter hub in vertical position, and overfill and wash the hub with the balance of the DMSO.
5. Connect Onyx syringe to the hub, begin injecting onyx to displace DMSO

Injection
slow, steady rate
0.16ml/min
(0.25ml/90sec)
Do not exceed 0.3 ml/min
→ Vasospasm

Only use thumb pressure to inject Onyx.
What will happen?

The DMSO solvent dissipates into the blood

- copolymer precipitate in situ into a spongy, coherent embolus.

- Onyx immediately forms a skin as the polymeric embolus solidifies from the outside to the inside
Conclusion

- Choose the right tool for the right patient
- Large number of material available
- Good knowledge is very important
- Embolization is a complex field
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