The New World of (Micro)Plugs

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• **Stock:** Embomedics

• **Speakers Bureau:** Boston Scientific, AngioDynamics, Siemens, Medtronic, Penumbra, Guerbet
Why Plug?

- Usually one device may be enough to occlude the vessel
  - Faster
  - Less radiation
  - Lower cost
Plugs

AVP I

AVP II

AVP III

AVP IV
AVP I

The Amplatzer Vascular Plug (AVP): Nitinol-based self-expanding cylindrical device
Two Platinum marker bands in each end
A stainless steel microscrew allows for the attachment of the plug

<table>
<thead>
<tr>
<th>AMPLATZER Vascular Plug Diameter</th>
<th>Device Length</th>
<th>Sheath Minimum Requirements</th>
<th>Minimum Internal Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mm</td>
<td>7 mm</td>
<td>4 F</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>6 mm</td>
<td>7 mm</td>
<td>4 F</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>8 mm</td>
<td>7 mm</td>
<td>4 F</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>10 mm</td>
<td>7 mm</td>
<td>5 F</td>
<td>0.066&quot;</td>
</tr>
<tr>
<td>12 mm</td>
<td>8 mm</td>
<td>5 F</td>
<td>0.066&quot;</td>
</tr>
<tr>
<td>14 mm</td>
<td>8 mm</td>
<td>6 F</td>
<td>0.087&quot;</td>
</tr>
<tr>
<td>16 mm</td>
<td>8 mm</td>
<td>6 F</td>
<td>0.087&quot;</td>
</tr>
</tbody>
</table>
AVP II

- Multi-layered design increases density and flow disturbance for more rapid occlusion.

- Recommendation is to oversize about 30%

Interventionalist can adjust the length and size of the cells.

<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>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>6</td>
<td>4 Fr</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>4 Fr</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>4 Fr</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>4 Fr</td>
<td>0.056&quot;</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>5 Fr</td>
<td>0.070&quot;</td>
</tr>
<tr>
<td>12</td>
<td>9</td>
<td>5 Fr</td>
<td>0.070&quot;</td>
</tr>
<tr>
<td>14</td>
<td>10</td>
<td>6 Fr</td>
<td>0.086&quot;</td>
</tr>
<tr>
<td>16</td>
<td>12</td>
<td>6 Fr</td>
<td>0.086&quot;</td>
</tr>
<tr>
<td>18</td>
<td>14</td>
<td>7 Fr</td>
<td>0.098&quot;</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
<td>7 Fr</td>
<td>0.098&quot;</td>
</tr>
<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 braided catheters (not hydrophilic)

Miniaturized Micro Screw
Extended Applications

• Varicoceles/Pelvic congestion
• Gastric varicose veins
• GDA embolization for
  – Radioembolization
  – GI bleeding
• AVM
  – PAVMs
  – Others
Extended Applications

• Aneurysm

• Large vessel occlusions
  – Internal iliac artery prior AAA repair
  – Subclavian artery for Thoracic aneurysm repair
  – Others (Spleen, renal, hepatic, ….)

• Carotid blow out
Limitations

• Not microcatheter compatible
  – Need large size Sheath
• Time to occlusion can be long
  – Lack of occlusion
MVP® Micro Vascular Plug
MVP™ Micro Vascular Plug System

- MVP™ plug system:
  - Deliverability through a micro catheter
  - Immediate Occlusion
  - Resheathability
  - Super-selective access
  - Fast and Predictable Deployment
  - Potential Cost Savings
**MVP™ Micro Vascular Plug System**

<table>
<thead>
<tr>
<th>MVP System</th>
<th>Target Vessels</th>
<th>MVP System Length Unconstrained</th>
<th>MVP System Width Unconstrained</th>
<th>Microcatheter ID Recommended</th>
<th>Microcatheter Length Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVP-3</td>
<td>1.5 – 3.0mm</td>
<td>12mm</td>
<td>5.3mm</td>
<td>0.021”</td>
<td>&lt;150cm</td>
</tr>
<tr>
<td>MVP-5</td>
<td>3.0 – 5.0mm</td>
<td>12mm</td>
<td>6.5mm</td>
<td>0.027”</td>
<td>&lt;150cm</td>
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</tbody>
</table>
New MVP

• New generation with larger sizes are available:

  – MVP 7Q: 5-7 mm (0.035”)
  – MVP 9Q: 7-9 mm (0.038”)
Cost Comparison – Coil Utilization
GDA Occlusion (JVIR 2013 Maleux)

<table>
<thead>
<tr>
<th>Number Devices to Occlude GDA</th>
<th>Hydrogel detachable microcoils</th>
<th>Hydrogel pushable microcoils</th>
<th>Fibered platinum microcoils</th>
<th>MVP® Micro Vascular Plug MVP-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.9</td>
<td>5.5</td>
<td>11.5</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Associated Cost/Device</th>
<th>$1100</th>
<th>$800</th>
<th>$150</th>
<th>$1950</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Total Device Cost to Occlude</th>
<th>$3,190</th>
<th>$4,400</th>
<th>$1,725</th>
<th>$1,950</th>
</tr>
</thead>
</table>

| Time to Occlude              | 25 min                         | 32 min                       | 20 min                      | -                            |

NOTE: MVP-5 for comparison (not used in study)
Coils utilized in study

• Hydrogel detachable coils (Azur Peripheral HydroCoil® Embolization System, Terumo)
• Hydrogel pushable coils (Azur Peripheral HydroCoil® Embolization System, Terumo)
• Fibered platinum coils (Target®, Boston Scientific)

Maleux JVIR 2013 Jun:24(6)797-803
Limitations

• Not ideal for high flow situations
• May not occlude immediately when placed in an angled vessel
• The Plug may be too long in some clinical situations
• Sizing is very important
EOS ArtVentive

Developed for percutaneous occlusion of the peripheral vasculature

- EOS™ Guiding Catheter including Dilator
- EOS™ Delivery Catheter
- EOS™ Implant

Impermeable ePTFE and Nitinol rings for radial force
Available in three sizes (5, 8 and 11mm)
The EOS™ device is compatible with 6 and 7.5F guides depending on size (5, 8 and 11mm)

The EOS™ is delivered via the guide which first goes over the wire and then through it after the guide wire is removed. Operator has the ability to retrieve the device into/through the guide before deployment (FIGURES 1 & 2)

Flush the EOS™ with a saline/contrast solution to enable two stage deployment with immediate occlusion after the first stage (FIGURE 3)

The EOS™ can be repositioned after the first stage of deployment (FIGURE 4)

The EOS™ is disengaged from the delivery catheter after the second stage of deployment (FIGURE 5)
Clinical Results of Arterial Case

SPLENIC ARTERY post surgery trauma bleeding. One EOS™ device was used to stop the flow immediately and permanently.

Performed at Johns Hopkins University, Baltimore, MD – presented/published at JVIR, Sept 2015

Proximal Left Ovarian Vein Occluded with EOS™

PELVIC CONGESTION SYNDROME performed at Lublin University Hospital, Poland
EMBA Hourglass™

• Precise, predictable stent-like delivery
  – Over the wire delivery
  – 5F integrated delivery catheter with pre-loaded device for 10mm plug

• Immediate focal occlusion and long term stability
  – Retractable and repositionable
  – Secure anchoring with no migration

• Enables a single device procedure in a wide range of vessels
  • 4 sizes will treat from 1.5-13.0 mm
  • Able to replace a large coil inventory
Conclusions

• Many new plugs and Microplugs
  – Much more to come
• Improved profile however not yet optimal
• Immediate occlusion
• Potentially cost-effective