Balloon Assisted Maturation of Arteriovenous Fistulae (AVF)
It works!*

Joseph A. Rapp, MD

*As well as anything else in Dialysis Access Surgery

Physiology of AVF maturation

- Understood that arterial and venous luminal expansion occurs
  - Endothelium-dependent in animal models
- Endothelial dysfunction in renal impaired patients known
- Successful fistula maturation depends upon BOTH artery and venous dilation

AVF procedures increase but maturation only 50-80%*

Physiology of experimental high flow stimulus

- **Seconds**: increased calcium entry
- **Minutes**: increased eNOS phosphorylation
- **Hours**: increased eNOS gene transcription
- Other EDRFs operative: PGI2 & EDHF

*Chest 2005; 127:2254-2263

* Allan 2002; Kidney Int
Successful fistula maturation

Reasons for early intervention

- Fistulae at risk can be identified within first week or two
- Early intervention critical to positively impact maturation process

Lesions Found in AVF that fail to mature

- Venous narrowing (65-100%)
  - Majority in "swing segment"
- Anastomotic narrowing (27-47%)
  - Often with narrowing of vein near anastomosis
- Arterial narrowing (6-38%)
- Mixture of lesions the rule
  - All generally treatable with angioplasty
Push the button!

1. Angioplasty
2. Leave it alone it will be OK
3. Abandon fistula

Push the button!

1. BAM
2. Leave it alone it will be OK
3. Abandon fistula
Maturation dependent on arterial size

<table>
<thead>
<tr>
<th>Lumen</th>
<th>&lt;1.5mm</th>
<th>&gt;1.5mm</th>
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<tr>
<td>1 d</td>
<td>138±10</td>
<td>184±13</td>
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<tr>
<td>1 wk</td>
<td>169±11</td>
<td>202±14</td>
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<tr>
<td>3 wk</td>
<td>274±17</td>
<td>360±17</td>
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<tr>
<td>8 wk</td>
<td>394±86</td>
<td>488±95</td>
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<td>12 wk</td>
<td>438±87</td>
<td>562±131</td>
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Malvota, 1998; Nephrol Dial Transplant

Brachial artery flow mediated dilation

9.5%
Can we dilate the arterial side of the AV fistula?

- 24 cimino fistulae with arterial stenosis
- 2-18 mo post fistula creation
- Angioplasty 3.5-5mm, ≥10cm in 11 arteries
- Primary patentcy 74% at 2 years and secondary patency 86%
- One artery thrombosed, no limb ischemia

Raynaud 2009; J Vasc Surg
Reported patency rates for early angioplasty of AVF

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<td>39%</td>
<td>79%</td>
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<td>Turmel-Rodrigues 2001</td>
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<td>28%</td>
<td>85%</td>
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<td>34%</td>
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<td>22%</td>
<td>52%</td>
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Protocol for AVF success

- Ultrasound evaluation of artery and vein prior to fistula creation
  - Vein must be ≥3mm, artery ideally 2mm
- Likelihood of success can be determined at first f/u visit
- Problem fistulae
  - Angioplasty q 2 weeks with 1-2mm increase each angioplasty
  - Low threshold for angioplasty arterial inflow

Summary

- It may not be scientific, pretty or uniformly successful
- But aggressive dilation of the AVF vein and artery has increased the number of usable fistulae in our practice