Indications for percutaneous and surgical creation of AVFs at the elbow: the radiologist’s point of view

Richard Shoenfeld MD, FSIR, FAHA
The Access Center at West Orange
West Orange, New Jersey
USA
Disclosure

Richard Shoenfeld, MD, FSIR, FAHA

.............................................................

I do not have any potential conflict of interest
Four cardinal questions concerning endoAVFs

1. Is endoAVF the functional equivalent of sAVF?
2. Does endoAVF have early advantages compared to sAVF?
3. Does endoAVF have the same or fewer potential complications than sAVF?
   - Primary failure, high resistance, stenosis, aneurysmal dilatation, high output, distal ischemia
4. In case of failure, does endoAVF prevent other options?
5. Is endoAVF non-inferior to sAVF?
6. Does endoAVF have the same or better durability than sAVF?
7. What are some potential indications for endoAVF?
8. Should endoAVF be the first fistula?
Is an endoAVF the functional equivalent of a sAVF?

**Proximal RA surgical AVF**
- Incision, dissection, mobilization
- Calibrated suture anastomosis
- Ligate competing venous outflow
- Wound closure, post-op pain, scar
- Procedure time: ≥ 1 hour

**endoAVF (proximal RA)**
- US-guided vein then radial A. puncture
- Endo-anastomosis, 5-mm angioplasty
- ± occlude competing venous outflow
- Band-aid to puncture site, no pain or scar
- Procedure time: ≥ 15 minutes

Does endoAVF have early advantages compared to sAVF?

**elbow sAVF**
- Same day surgery, inpatient
- OR Scheduling issues
- Surgical skills, technically demanding
- Post-operative recovery; morbidity
- Progressive hypertrophy, maturation
- Early, immediate use not recommended

**endoAVF**
- Outpatient (drive-by) procedure
- No wait
- Basic catheterization skills; not demanding
- No post-op recovery; no or minimal morbidity
- Immediate high arterial flow
- Early or immediate use, if necessary
Does endoAVF have the same or fewer potential complications than sAVF?

**RC AVF: the gold standard**
- Moderate flow, low-moderate pressure
- Cephalic arch obstruction: rare
- Distal ischemia: 1-4%
- High output: almost never
- Lower risk of arm swelling with CV obstruction

**BC AVF**
- High-flow, high pressure, aneurysmal dilatation
- Cephalic arch obstruction: frequent
- Distal ischemia: 15-22%
- High output: not uncommon
- Higher risk of arm swelling with CV obstruction

**endoAVF behaves like a proximal RC AVF**
- Moderate flow, low-moderate pressure
- Cephalic arch obstruction: rare
- Distal ischemia: 1-4%
- High output: almost never
- Lower risk of arm swelling with CV obstruction
## Is endoAVF non-inferior, as durable as sAVF?

<table>
<thead>
<tr>
<th>Group (overall)</th>
<th>Study/Author</th>
<th>Technical Success</th>
<th>Primary Patency</th>
<th>Cumulative Patency</th>
<th>Assisted 1º Patency</th>
<th>(suitable for dialysis) (Qa &gt; 500 ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brachial-Cephalic AVF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Almasri</td>
<td>0.526 @130 wks</td>
<td>0.573 @ 104.5 wks</td>
<td>0.966 @260 wks</td>
<td>0.863 @ 6 wks</td>
<td></td>
</tr>
<tr>
<td>Brachial- Basilic AVF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Almasri</td>
<td>0.582 @ 104 wks</td>
<td>0.722 @ 91 weeks</td>
<td>0.857 @65 wks</td>
<td>0.780 @ 34.15 wks</td>
<td></td>
</tr>
<tr>
<td>Radio-Cephalic AVF&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Almasri</td>
<td>0.554 @ 104 wks</td>
<td>0.536 @ 104 weeks</td>
<td>0.858 @52 wks</td>
<td>0.781 @ 45.5 wks</td>
<td></td>
</tr>
<tr>
<td>Proximal RC AVF&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jennings</td>
<td>0.6 @ 12 mos</td>
<td>0.93 at 12 months</td>
<td>0.9 @ 12 mos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal RC AVF</td>
<td>Inston</td>
<td>0.926</td>
<td>0.667 @ 6 mos.</td>
<td>0.93 at 12 months</td>
<td>0.91 at 24 months</td>
<td></td>
</tr>
<tr>
<td>endoAVF WavelinQ</td>
<td>Inston</td>
<td>0.967</td>
<td>0.758 @ 6 mos</td>
<td>0.93 at 12 months</td>
<td>0.96 @ 6 mos</td>
<td></td>
</tr>
<tr>
<td>endoAVF Ellipsys&lt;sup&gt;6&lt;/sup&gt;</td>
<td>PIVOTAL</td>
<td>0.95</td>
<td>0.867 @ 12 mos</td>
<td>100 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>endoAVF Ellipsys (early results)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Mallios</td>
<td>0.96</td>
<td>0.92 @ 3 mos.</td>
<td>0.96 @ 6 wks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>endoAVF Ellipsys (early can.)&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Mallios</td>
<td>1.00</td>
<td>1.00</td>
<td>1-12 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>endoAVF EverlinQ&lt;sup&gt;5&lt;/sup&gt;</td>
<td>NEAT</td>
<td>0.98</td>
<td>0.96 @ 12 mos</td>
<td>0.46 interv/pt-yr</td>
<td>52/60; 0.87 @ 3 mos</td>
<td></td>
</tr>
</tbody>
</table>

---

<sup>2</sup>Jennings, W.C. et al. J Vasc Surg 2018  
<sup>4</sup>Mallios A. et al. J Vasc Access 2019  
<sup>5</sup>Lok, C. et al. Am J Kidney Dis 2017  
<sup>6</sup>Hull, J. et al. J Vasc Interv Radiol 2018
Potential indications for endoAVF

- RC AVF – poor anatomy, failure
- High BMI patients (up to 44 kg/m²)
- Candidates for BC/BB AVF
- Stage I: transposition, elevation BC/BB AVF
- Dialysis pts; early cannulation - avoid initial or problematic PC,¹ early use AVG
- Non-dialysis pts; need for early dialysis
- H/O elbow AVF, distal ischemia + need for new AV access
- The elderly (> 70 years)
- Diabetics with heavily calcified distal RA?
- ESRD + cardiomyopathy (RC AVF not possible)
- Dual vein cannulation; avoid recirculation
- Surgical fatigue

¹Mallios A. et al. J Vasc Access 2019
Should endoAVF be the *first fistula*?

**endoAVF (WavelinQ) vs sRC AVF**

- Clinical outcomes
  - endoAVF ≥ surgical BC AVF
  - BC AVF > RC AVF
- Procedural success
  - endoAVF ≥ surgical RC AVF (96.7 vs 92.6%)
- Failure in the first year
  - endoAVF < RC AVF (30.5% vs 42.4%)
- Preservation of surgical sites
  - endoAVF preserves upper arm options
  - sRC AVF after endoAVF
  - endoAVF after sRC AVF

*Inston, N. et al. J. Vasc Access 2019*
endoAVF Challenges

Suboptimal anatomy
Choice of endoAVF systems
How much embolization, if any?
Dialysis nurses’ comfort with endoAVFs
Challenges of early cannulation
POCUS available in dialysis centers
Paucity of results compared to surgery
Need to protect veins from phlebotomists, iv’s, etc.
Internet, word of mouth: patient demand for endoAVF rather than surgical AVF
endoAVF – The Radiologists’s Perspective

Goal  = sustained clinical use of AV access
Easy, safe creation of functional AVF; high success rate
Early Physiologic maturation; low reintervention rate
Early clinically useful AVF
Early CVC removal
Preservation of venous capital and future access options
Consider: endoAVF as first fistula in fistula first.