Management of Popliteal Artery Aneurysms

Endovascular vs Open Repair

Neal S Cayne, MD
Director of Endovascular Surgery
Division of Vascular Surgery
New York University Langone Medical Center
New York, NY
NO DISCLOSURES
Popliteal Artery Aneurysms (PAAs)

- Male Predominance
- Most common peripheral aneurysm (70%)
- 30-50% have AAA
PAAs

- Rarely Rupture
- Acute/Chronic ischemia 2° embolization/thrombosis
Natural History of PAAs

• *Dawson et al – 71 PAA/51 Pts
• 25 – Observed
  • Complications
    - 12/21 (57%) asymptomatic
    - 2/4 (50%) symptomatic
  • ↑74% at 5 years

Natural History of PAAs

• *Szilagyi et al –

• Only 32% of nontreated PAAs remained without LE complications at 5 years

Treatment of PAAs

1) PAAs $\geq 2.0$ cm
   - 30-40% risk of ischemia
   - high rate of limb loss

2) Symptomatic patients
Treatment of PAAs

- Decision and Technique for Repair must be *individualized*!
  - Co-morbidities
  - Anatomy
  - Degree of Ischemia
Imaging of PAAs

CTA or MRA (Abd-feet)

- Extent of disease/
  Concomitant disease (AAA)
- Anatomy/Size/Tortuosity of vessels/Thrombus
- Runoff vessels
Repair of PAAs

- **Acute Threatening Ischemia**
  - 3-4x Mortality; Higher limb loss
  - Heparin → CTA? → OR(Hybrid)
  - Angio / Lysis / Thrombectomy
  - Open or Endovascular Rx
Repair of PAAs

- Asymptomatic/Chronic ischemia
  - Medical/Cardiac Assessment
  - Imaging - CTA / Angio
  - Open vs Endo vs Observation
Open Repair of PAAs

- Requires **General Anesthesia**

- **Posterior Approach**
  - *Interposition graft*

- **Medial Approach**
  - *Exclusion and Bypass*
Posterior Approach

- Patient prone
- Relieve compressive Sx
- Limited prox/dist dissection
- GSV harvest more difficult
  - Can use SSV if size OK
- **Advantage** - Can debulk and ligate collaterals
  - Prevent type 2 leaks
Posterior Approach
Medial Approach

• Easier GSV harvest
• Can extend proximally and distally (tibial vessels)
• PAA exclusion without collateral ligation – PAA can grow/rupture (Type 2 leak)
Medial Approach
PoLttleal Artery Aneurysm Repair

Open Repair - Outcomes

- 5 yr Patency (all comers): 64%-75%*

- Elective
  - Autologous
    - *GSV: primary - 80%; secondary - 90%
  
  - Synthetic
    - PTFE: primary - 50%; secondary - 63%

≈ 30% diff

Endovascular Treatment of PAAs (EPAR)

- Alternative to open repair
- * Local Anesthesia
- “Off-Label use” of stent graft
First Reported Endovascular PAA Repair – Homemade Graft

Marin, Veith et al 1994 - Montefiore

3 Months PO
NYU study of EPAR - *JVS

• Retrospective review of consecutive EPAR patients at NYU

• 26 PAAs in 21 patients

## Patient/Aneurysm Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (years)</td>
<td>74 ± 9</td>
</tr>
<tr>
<td>Male Gender</td>
<td>19/21 (90.5%)</td>
</tr>
<tr>
<td>Bilateral Popliteal aneurysms</td>
<td>10/21 (48%)</td>
</tr>
<tr>
<td>History of AAA</td>
<td>11/21 (52%)</td>
</tr>
<tr>
<td>Median diameter (cm)</td>
<td>2.89 ± 1.0</td>
</tr>
<tr>
<td>Percentage Asymptomatic</td>
<td>16/26 (62%)</td>
</tr>
</tbody>
</table>
Anatomic Selection Criteria

• 2 CM landing zones
  - 10-15% luminal oversize
• Minimal proximal/distal size discrepancy
• Lack of extensive vessel tortuosity
Anatomic Selection Criteria

- Knee < 90° flexion (carpenters, gardeners)
- No contraindication to antiplatelet medication
  - Plavix predictor of success (*Tielliu)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Anesthesia</td>
<td>10/26 (38%)</td>
<td></td>
</tr>
<tr>
<td>Technical Success</td>
<td>25/26 (96%)</td>
<td></td>
</tr>
<tr>
<td>Crossing Knee Joint (%)</td>
<td>24/25 (96%)</td>
<td></td>
</tr>
<tr>
<td>Number of stents</td>
<td>1.8 ± 1.1</td>
<td></td>
</tr>
<tr>
<td>Distal Runoff (mean #)</td>
<td>1.96 ± 0.75</td>
<td></td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>2.4 ± 2.4</td>
<td></td>
</tr>
<tr>
<td>Follow up (months)</td>
<td>22 ± 17</td>
<td></td>
</tr>
<tr>
<td>ASA and/or Plavix</td>
<td>26/26 (100%)</td>
<td></td>
</tr>
</tbody>
</table>
OR – EPAR Procedure
OR – Angiogram with Knee Bent
NYU- EPAR Outcomes

- Primary patency
  - 91% at 1 year
  - 86% at 2 years
- Secondary patency
  - 91% at 1 year
  - 91% at 2 years
- No Limb loss
• 3 occlusions during follow up
  - 4, 14 and 26 months
  - 1 patient required a tibial bypass for a non-healing wound
  - 2 patients underwent successful open thrombectomy
• * All occlusion patients had single vessel run-off
### Predictors of stent graft occlusion

<table>
<thead>
<tr>
<th>Predictor</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>NS</td>
</tr>
<tr>
<td>*Run-off</td>
<td>0.02</td>
</tr>
<tr>
<td>Number of stents deployed</td>
<td>NS</td>
</tr>
<tr>
<td>Sheath diameter</td>
<td>NS</td>
</tr>
<tr>
<td>Indication for Rx</td>
<td>NS</td>
</tr>
</tbody>
</table>
NYU - EPAR vs OPEN

- Retrospective - 1998-2013
- 79 PAA (69 pts)
  - 36 OR; 43 EPAR
  - Similar – Age, Comorbidities, PAA size, Runoff, Sx
  - F/u longer in OR (75 vs 34 mo)
NYU - EPAR vs OPEN

- Patency (5 yr – Kaplan-Meier)
  - $1^\circ$ - 67% OR; 80% EPAR (p>0.05)
  - $2^\circ$ - 90% both groups
NYU - EPAR vs OPEN

• LOS(d) - 6.4 OR; 1.9 EPAR (p<.001)

• 1 Amputation – OR

• EPAR - 1 vessel runoff – higher occlusion rates (p=.003)
Outcomes - EPAR

* Mohan et al

• 30 PAA – EPAR
  - 3 yr 1°, 2° patency - 75%, 83%
  - Similar to open surgery

Outcomes - EPAR

* Tielliu et al

- 73 PAA – EPAR
  - 5 yr 1°, 2 ° patency
    - 70%, 76%
  - 1° patency ↑ 80%
  - Experience and Plavix
Outcomes

* Antonello et al

• 30 PAAs – Open vs EPAR
  • *Prospective Randomized
    - No diff limb salvage/patency (4yr)
    - ↓ operative time/LOS - EPAR

Outcomes

*Lovegrove et al

• Meta-analysis - Open vs EPAR
  - No diff - long term patency
  - ↓ operative time/LOS - EPAR
  - EPAR – more likely to have thrombosis/reintervention-30d

*Lovegrove et al. Endovascular and open approaches to non-thrombosed popliteal aneurysm repair: a meta-analysis. Eur J Vasc Endovasc Surg 2008;36:96-100..
Outcomes – Multilayered Stents

*Thakar et al

- 6 PAAs - Multilayered stent - 50% occlusion rate at 6 months

Outcomes - Multilayered Stents

*Antoniou et al.*

- 6 PAAs (3 pts) – Multilayered stent
  - 2/6 (33%) occluded at 9 month f/u

Conclusions

- The decision, timing, and technique to perform open or endovascular repair of PAAs should be *individualized.*
Conclusions

- Endovascular repair of PAAs is relatively safe with patency/limb salvage rates comparable to open repair in patients that have appropriate anatomy.
Conclusions - EPAR

- EPAR - ↓ LOS/Procedure Time
- Caution EPAR - 1 vessel runoff
- Plavix - May ↑ EPAR Patency
- Await FDA approval for EPAR