Endovascular Grafts should be first choice for treating Popliteal Aneurysms: When are they contraindicated and Technical tips to get good results.

Associate Professor Irwin V Mohan
MBBS, MD, FRCS, FEBVS, FRACS
Vascular and Endovascular Surgeon
irwin_mohan@hotmail.com
Westmead Hospital,
University of Sydney
Australia

WHY REPAIR Popliteal Artery Aneurysms (PAA)???

• Avoid Complications
• Compression symptoms
• Distal embolization
• Rupture

Main Aim of treatment is to Prevent Limb loss!!

Mohan IV, EJVES 2006; 32:149-54,

Large series of patient with OPAR in SwedVasc Registry

Surgical technique and long-term results after popliteal artery aneurysm repair: Results from 717 legs

Mohan IV, EJVES 2006; 32:149-54,

Results of Open PAA Surgery

• Repair of aneurysm with interposition graft or exclusion of aneurysm with bypass.
• Mortality
  0-1% asymptomatic
  2.1% symptomatic
• Wound associated morbidity 10-20%
• Risk of limb loss, 11% overall, (80% within 1 year).
  Limb loss 21% acute ischemia.

Patency rates for elective open repair

30 days: vein 93%, prosthetic 87%
1 year: vein 87.5%, prosthetic 76%
Mean 7.2 (2 to 18) yrs, vein 85%, prosthetic 65%

p<0.05

Results of Open PAA Surgery

Australasian Vascular Audit (AVA)
Australia and New Zealand Society of Vascular Surgery

• 5 year prospectively collected data for Popliteal Artery Aneurysms, between 2010-2014 from the AVA.
• Median diameter: 22 (18-100) mm
• Demographic and risk factor data, intraoperative details, and complications were collected for all patients up to discharge.
• Univariate analysis was performed, and data was used to create backward regression models.

p<0.05
**Popliteal Artery Aneurysms**

(1316 PAA, 396 stents, 920 bypasses)

### Urgency of Procedure

<table>
<thead>
<tr>
<th>Urgency of Procedure</th>
<th>Patients treated with Stent (396)</th>
<th>Patients treated with Bypasses (920)</th>
<th>Total (1316)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>336 (84.8%)</td>
<td>686 (74.6%)</td>
<td>1022 (77.7%)</td>
</tr>
<tr>
<td>Symptomatic (Semi-Urgent)</td>
<td>46 (9.1%)</td>
<td>153 (16.6%)</td>
<td>189 (14.4%)</td>
</tr>
<tr>
<td>Emergency</td>
<td>24 (6.1%)</td>
<td>81 (8.8%)</td>
<td>105 (8.0%)</td>
</tr>
</tbody>
</table>

**Bypass Conduits and Anastomotic Sites for patients having bypass and stent procedures.**

**Bypass Conduits (920 patients)**

- Autologous material: 89.9%
- Good Quality: 82.9%
- Suboptimal: 7.0%

**Prosthetic (PTFE):** 10.1%

**Proximal Anastomotic Site**

- Supra-inguinal vessel: 0.6%
- Common Femoral Artery: 12.0%
- Superficial Femoral Artery: 63.8%
- Deep Femoral Artery: 0.1%
- Popliteal Artery: 20.7%
- Other Bypass graft: 2.8%

**Distal Anastomotic Site**

- Above knee popliteal: 8.3%
- Below knee popliteal: 73.2%
- Tibial vessels: 19.5%

**Stent Graft (Viabahn- Heparin Bonded) (n=396)**

- 100%

**Median Diameter:** 9mm (25-75% IQR, 8 to 11mm)

**Median Length:** 150mm (25-75% IQR, 100 to 250mm)

**Distal Landing Zone- BK Popliteal:** 100%

**Complications for all Popliteal Aneurysms, subdivided for stents and bypasses.**

<table>
<thead>
<tr>
<th>Comparison Variable</th>
<th>All complications (n=1316)</th>
<th>Stent (n=396)</th>
<th>Bypass (n=920)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>All complications</td>
<td>138 (10.5%)</td>
<td>20 (5.1%)</td>
<td>118 (12.8%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Bleeding requiring reoperation</td>
<td>35 (2.7%)</td>
<td>7 (1.8%)</td>
<td>28 (3.0%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Wound complications</td>
<td>39 (3.0%)</td>
<td>6 (1.5%)</td>
<td>33 (3.6%)</td>
<td>p=0.042</td>
</tr>
<tr>
<td>Cardiac complications</td>
<td>16 (1.2%)</td>
<td>2 (0.5%)</td>
<td>14 (1.5%)</td>
<td>NS</td>
</tr>
<tr>
<td>Respiratory Complications</td>
<td>10 (0.8%)</td>
<td>0</td>
<td>10 (1.1%)</td>
<td>p=0.038</td>
</tr>
<tr>
<td>Renal complications</td>
<td>8 (0.6%)</td>
<td>2 (0.5%)</td>
<td>6 (0.7%)</td>
<td>NS</td>
</tr>
<tr>
<td>Gastrointestinal Complications</td>
<td>4 (0.3%)</td>
<td>2 (0.5%)</td>
<td>2 (0.2%)</td>
<td>NS</td>
</tr>
<tr>
<td>CNS Complications</td>
<td>2 (0.2%)</td>
<td>0</td>
<td>2 (0.2%)</td>
<td>NS</td>
</tr>
<tr>
<td>Failed Repair</td>
<td>48 (3.6%)</td>
<td>6 (1.5%)</td>
<td>42 (4.6%)</td>
<td>p=0.007</td>
</tr>
</tbody>
</table>

**Model for any complication (all patients, includes stents and bypass).**

**Comparison Variable**

- Bypass surgery vs stenting: OR: 2.87; 95% CI: 1.74-4.72; P<0.0001
- Presence of IHD: OR: 2.02; 95% CI: 1.39-2.92; P<0.0001
- Emergency Surgery vs Elective Surgery: OR: 2.98; 95% CI: 1.75-5.07; P<0.0001

**Model for occlusion or amputation (including stents or bypasses only).**

**Comparison Variable**

- Stents only: ANA Score: OR: 4.03; 95% CI: 0.53-30.65; P=0.179
- Bypasses only: Suprarenal vs iliac: OR: 2.11; 95% CI: 0.92-4.85; P=0.078

**Other Large studies**

- Retrospective multicentric study on 312 PAAs.
- NO significant differences between open (178 PAAs) and endovascular (134 PAAs) repair in terms of primary and secondary patency.
116 patients, 110 OPAR, 76 EPAR
• Reintervention rates, p=0.13
• Amputation rates, OR (4) vs ER (1), p=0.65
• Patency Rates, no differences

Meta-Analysis Data (514 PAA)
No difference was found in primary patency for OPAR or EPAR on evidence synthesis.
(hazard ratio 1.30, 95% CI 0.79 to 2.12, p=0.189).

Contemporary outcomes of open and endovascular popliteal artery aneurysm repair

A Report from the Vascunet Collaboration of Registries.
Contemporary Treatment of Popliteal Artery Aneurysm in Eight Countries

European Journal of Vascular and Endovascular Surgery 2014; 47:164-171

• 1471 popliteal aneurysms
• The overall major amputation rate was 2.0%.
• Amputation in 6.5% after emergency procedures for thrombosis.
• Amputation rate with surgical technique:
  1.0% after endovascular (307), 1.8% after open (1145).
• 26.3% after hybrid repair, (19 patients, p <.0001).

Graft Deployment Technique

Endovascular Popliteal Aneurysm Repair
Patient to exclude;

Age: EPAR not recommended for young patients with suitable vein: < 50 years.
Comorbidities:
• Renal failure
• Low Output Heart Failure!!
• Poor distal runoff
Extensive aneurysms, with severe angulation and distortion may complicate stent delivery and placement.
Contraindications to antiplatelet agents.
Adjunctive Therapy

Antiplatelet agents essential!!!!

Monotherapy or combination therapy with clopidogrel

Regression analysis (by Groningen group) demonstrated graft occlusion related to Non-use of Clopidogrel


Hybrid approach with PTFE sleeve. “The French Fillet”.

Dr Chiche’s Muscle Cutting procedure

- Under general anesthesia, the PAA was approached through a single anteromedial incision including division of;
  - sartorius,
  - gracilis,
  - semitendinosus muscles in most cases
  - medial head of the gastrocnemius muscle.

Muscles are important structures of the leg!!

- Patients aged 22-89 years.
- All patients were ASA I-III!!
- Patients probably not able to run/walk again!
1. Fillet muscles of the leg.
2. Resect a good segment of SFA, ligate all tributaries.
3. Translocate this to the popliteal artery.
4. Replace with prosthetic graft.
5. Cover translocated artery with PTFE sleeve to prevent further aneurysms.
6. Repair all transected muscle.

A good French Recipe
(17 surgeons)

Summary

• EPAR has come of age.
• Popliteal aneurysm stenting can deliver results comparable to open bypass with vein grafts.
• Procedural technique must include a flexed knee completion angiogram.
• Medically unfit patients are not good candidates for EPAR (or OPAR).

Results

• One aneurysmal degeneration.
• One case of graft infection, treated by removal of the synthetic graft and bypass using an arterial autograft. The bypass was occluded on the 1-month.
• 11 (16.4%) thromboses were observed.

Thank you