Heparin bonded graft could challenge endovascular repair for TASC C-D lesions?

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University of Florence - Italy
Disclosure

Speaker name: ...................................................................................

I have the following potential conflicts of interest to report:

☑ Travel grant from Gore Company
☐ Employment in industry
☐ Shareholder in a healthcare company
☐ Owner of a healthcare company
☐ Other(s)

☐ I do not have any potential conflict of interest
TASC classification of femoro-popliteal disease

- **TASC C:**
  - Multiple stenoses or occlusions totaling \(\geq 15\) cm with or without heavy calcification
  - Recurrent stenoses or occlusions that need treatment after two endovascular interventions

  \[
  \text{Recommendation 37} \\
  \text{Preferred treatment: SURGICAL} \\
  (\text{Comorbidities, patient preference and operator’s long-term success rates})
  \]

- **TASC D:**
  - Chronic total occlusions of CFA or SFA (\(\geq 20\) cm, involving the popliteal artery)
  - Chronic total occlusion of popliteal artery and proximal trifurcation vessels

  \[
  \text{Recommendation 37} \\
  \text{Treatment of choice: SURGICAL}
  \]

*Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II)*
European Vascular and Endovascular Monitor (EVEM)
Panel Report – 4th Quarter 2014

Femoro-popliteal / Tibial procedures
Gender-related outcomes in the endovascular treatment of infrainguinal arterial obstructive disease

Raffaele Pulli, MD, Walter Dorigo, MD, Giovanni Pratesi, MD, Aaron Fargion, MD, Domenico Angilella, MD, and Carlo Pratesi, MD Florence, Rome, and Bari, Italy

Fig 1. Kaplan-Meier curve for primary patency during follow-up with numbers of patients at risk and standard error (SE).

Fig 2. Kaplan-Meier curve for assisted primary patency during follow-up with numbers of patients at risk and standard error (SE).
Lesion severity and treatment complexity are associated with outcome after percutaneous infra-inguinal intervention

Brian G. DeRubertis, MD, Matthew Pierce, BS, Rabih A. Chaer, MD, Soo J. Rhee, MD, Rachid Benjeloun, MD, Evan J. Ryer, MD, Craig Kent, MD, and Peter L. Faries, MD, New York, NY
Gender-Related Long-term Outcome of Primary Femoropopliteal Stent Placement for Peripheral Artery Disease

Konstantinos Stavroulakis, MD, Konstantinos P. Donas, MD, PhD, Giovanni Torsello, MD, Nani Osada, PhD, and Eva Schönefeld, MD
Primary Stenting of TASC C and D Femoropopliteal Lesions: Results of the STELLA Register at 30 Months

Jean-Michel Devaine1,2, Julien Quérat1, Béatrice Guyomarch3, Alain Costargent1, Philippe Challiou1, Philippe Patra1,4, Yann Gouëffic1,2,4

Results

Among the 58 patients (62 limbs) included, 40.3% presented an effort ischemia and 59.7% a critical ischemia (CI). The mean age was 71 ± 12 years. The lesions were classified as TASC D in 37.1% of the cases. The median length of the stenting was 26 ± 18 cm. The average follow-up was 26.1 months (1–30). At 30 months, a complete follow-up was obtained in 55 patients (58 limbs). The rate of survival was 79.6%. Nine of the 11 patients deceased presented initially with CI. Death was in connection with CI in 2 cases. At the date of latest news, 96.3% of the patients were under antiaggregating treatment, 20% received antivitamin K treatment, 75% received statins, and 75% received angiotensin-converting-enzyme inhibitors. The rates of maintenance of the primary and secondary clinical improvement were 66.6 ± 5.6% and 99.1 ± 5.1% at 12 months, and 65 ± 6.6% and 79.4 ± 6.6% at 24 months, respectively. The Rutherford index was 4.1 ± 1.0 in preoperative, 0.7 ± 1.2 at 12 months, and 0.6 ± 1.1 at 30 months (P < 0.001). Two major amputations were carried out at 9 and 28 months for patients initially with CI. The mean systolic pressure index was 0.6 ± 0.1 in preoperative and 1.0 ± 0.2 at 1-year and 0.9 ± 0.3 at 30 months (P < 0.001). The rates of primary and secondary patency were 66 ± 6.3% and 80.9 ± 9.5% at 12 months and 62.2 ± 6.6% and 77.2 ± 5.9% at 30 months, respectively. Between 0 and 12 months, 12 (19.3%) intrastent restenosis (ISR) were noted. One ISR was observed after 12 months. At the same period, we observed 11 and 1 target lesion revascularization, respectively.

Conclusions

In the long run, the primary stenting of long FP lesions (>15-cm) is a safe and durable treatment. A strong clinical and ultrasound monitoring is indicated during the first year to maintain the clinical improvement.
Bypass versus Angioplasty in Severe Ischaemia of the Leg (BASIL) trial: An intention-to-treat analysis of amputation-free and overall survival in patients randomized to a bypass surgery-first or a balloon angioplasty-first revascularization strategy.

Overall, there was no significant difference in AFS or OS between the two strategies. However, for those patients who survived for at least 2 years after randomization, a BSX-first revascularization strategy was associated with a significant increase in subsequent OS and a trend towards improved AFS.

(Bradbury, J Vasc Surg 2010)
A meta-analysis of endovascular versus surgical reconstruction of femoropopliteal arterial disease

George A. Antoniou, MD, PhD, Nicholas Chalmers, FRCP, George S. Georgiadis, MD, Miltos K. Lazarides, MD, EBSQvasc, Stavros A. Antoniou, MD, Ferdinand Serracino-Inglott, MD, FRCR, J. Vincent Smyth, ChM, FCRS, and David Murray, MD, FRCS, Manchester, United Kingdom; Alexandroupolis, Greece; and Marburg, Germany

CONCLUSIONS

There is insufficient evidence to demonstrate the superiority of one method over the other. Existing randomized trials and observational studies are limited by the variability in disease severity and methods of treatment. An endovascular-first approach may be advisable in patients with significant comorbidity, whereas for fit patients with a long-term perspective, a bypass procedure may be offered as a first-line interventional treatment. Further randomized controlled trials evaluating the outcomes of surgical and endovascular treatment in carefully selected patients are required to delineate the efficacy of these methods for the treatment of femoropopliteal arterial disease.
Chapter IV: Treatment of Critical Limb Ischaemia


CLI (partially) based on SFA lesion

- Lesion length < 5 cm
  - PTA with provisional stenting

- Lesion length 5-15 cm
  - PTA with self-expandable stent

- Lesion length > 15 cm
  - Physical condition suitable for open procedure
    - Yes
      - Open bypass procedure (especially in younger patients and occlusive lesions):
        - Venous
        - Synthetic
    - No
      - Alternative for open:
        1. Stent graft
        2. Remute endarterectomy
        3. (Future cell-based therapies)
Critical appraisal of surgical revascularization for critical limb ischemia

Michael S. Conte, MD, San Francisco, Calif

<table>
<thead>
<tr>
<th>Surgical risk</th>
<th>Average (&lt;5%)</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life expectancy</td>
<td>≥ 2 years</td>
<td>Limited</td>
</tr>
<tr>
<td>Severity of ischemia</td>
<td>Major tissue loss</td>
<td>Minor ulcer</td>
</tr>
<tr>
<td>Anatomic pattern</td>
<td>Multi-level, TASC C/D</td>
<td>Single level TASC A/B/C</td>
</tr>
<tr>
<td>Vein availability</td>
<td>GSV or good quality alternative vein</td>
<td>Inadequate vein</td>
</tr>
</tbody>
</table>

↓

BYPASS FAVORED

↓

ENDO FAVORED (Or Hybrid)
Are they fighting or loving?
Hybrid procedures
Vascular Surgery-University of Florence 2005-2014

- 567 open and endovascular interventions for femoro-popliteal obstructive disease without tibial involvement
- 411 interventions performed for TASC-II C and D lesions
  - 194 HePTFE bypass
  - 111 vein bypasses
  - 58 endovascular procedures
  - 51 hybrid procedures
<table>
<thead>
<tr>
<th></th>
<th>HePTFE (194)</th>
<th>ASV (111)</th>
<th>EV (58)</th>
<th>Hy (51)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent claudication</td>
<td>54 (28%)</td>
<td>43 (39%)</td>
<td>34 (58%)</td>
<td>34 (66%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Critical limb ischemia</td>
<td>140 (72%)</td>
<td>67 (61%)</td>
<td>24 (42%)</td>
<td>17 (34%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Above the knee</td>
<td>41 (21%)</td>
<td>2 (2%)</td>
<td>31 (53%)</td>
<td>37 (72%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Below the knee</td>
<td>153 (79%)</td>
<td>109 (98%)</td>
<td>27 (47%)</td>
<td>14 (28%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
RESULTS IN PATIENTS WITH CLI

<table>
<thead>
<tr>
<th>Material</th>
<th>Primary patency @ 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>HePTFE</td>
<td>46.5%</td>
</tr>
<tr>
<td>ASV</td>
<td>58.2%</td>
</tr>
<tr>
<td>EV</td>
<td>12%</td>
</tr>
<tr>
<td>HY</td>
<td>-</td>
</tr>
</tbody>
</table>

p=0.009, log rank 11.5
RESULTS IN PATIENTS WITH CLI

<table>
<thead>
<tr>
<th>Material</th>
<th>Secondary patency @ 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>HePTFE</td>
<td>61%</td>
</tr>
<tr>
<td>ASV</td>
<td>67%</td>
</tr>
<tr>
<td>EV</td>
<td>14%</td>
</tr>
<tr>
<td>HY</td>
<td>-</td>
</tr>
</tbody>
</table>

p=0.08, log rank 6.7
RESULTS IN PATIENTS WITH CLI

Limb salvage @ 4 years

<table>
<thead>
<tr>
<th>Material</th>
<th>Limb salvage</th>
</tr>
</thead>
<tbody>
<tr>
<td>HePTFE</td>
<td>77%</td>
</tr>
<tr>
<td>ASV</td>
<td>82%</td>
</tr>
<tr>
<td>EV</td>
<td>81%</td>
</tr>
<tr>
<td>HY</td>
<td>-</td>
</tr>
</tbody>
</table>

p=0.8, log rank 0.6
“The great saphenous vein performs better than polytetrafluoroethylene in femoropopliteal bypass grafting and should be used whenever possible. However, the absence of a suitable saphenous remains an acceptable indication for a femoropopliteal bypass in PTFE.”

Pereira et al., Meta-analysis of femoropopliteal bypass grafts for lower extremity arterial insufficiency

An adequate caliber, good quality great saphenous vein (GSV) is the optimal graft for distal bypass in the leg. The availability of such a conduit is a relevant limitation of lower extremity bypass surgery: **good ipsilateral greater saphenous vein may be lacking in up to 40% of the patients**, and the strong relationship between vein diameter and graft failure makes autologous saphenous vein unsuitable in some 25% of the patients with critical limb ischemia.

(Conte, J Vasc Surg 2010)
PROPATEN (GORE-TEX®) is an ePTFE prosthetic graft with covalent end-point attachment of heparin to graft surface (CBAS), enabling maintenance of functional heparin bioactivity.

- **UNIFORM HEPARINIZATION**
- **RETENTION OF HEPARIN ON GRAFT SURFACE**
Experimental studies

- Acute canine interposition experiments comparing CBAS-PTFE grafts to control ePTFE grafts showed significantly greater thrombus-free luminal surface.

- In chronic canine interposition experiment, significantly improved patency was observed with CBAS-PTFE grafts.

  (Begovac, EJVES 2003)

- Long term in vivo heparin bioactivity was demonstrated on CBAS-PTFE grafts explanted between 1 and 12 weeks.
The Hb-PTFE graft significantly reduced the overall risk of primary graft failure by 37%. Risk reduction was 50% in femoro-popliteal bypass cases and in patients with critical ischaemia.

(Eur J Vasc Endovasc Surg 2011)
Italian Registry: participants centres

Università dell’Insubria - Varese

*Patrizio Castelli*

Università di Firenze

*Carlo Pratesi*

Ospedale di Avezzano

*Giovanni De Blasis*

Ospedale di Catania

*Vincenzo Monaca*

Ospedale di Mestre

*Vittorio Dorrucci*

Ospedale di Reggio Emilia

*Enrico Vecchiati*

Ospedale di Terni

*Fiore Ferilli*
1152 HePTFE bypasses
599 HePTFE below-knee bypasses
- 461 males (77%)
- 138 females (23%)

390 ASV below-knee bypasses
- 292 males (75%)
- 98 females (25%)
Comparison with autologous saphenous vein bypass in CLI

p<0.001; log rank 13.3

p=0.09; log rank 2.7
Comparison with autologous saphenous vein bypass in CLI

p=0.4; log rank 0.6

SE 0.03

p=0.08; log rank 4.2

SE 0.04
## Uni- and multivariate analysis for primary patency in HePTFE group

### Univariate analysis

<table>
<thead>
<tr>
<th></th>
<th>Log-rank</th>
<th>p</th>
<th>95% CI</th>
<th>OR</th>
<th>95% CI</th>
<th>OR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female gender</td>
<td>6.2</td>
<td>0.002</td>
<td>1.1-2.2</td>
<td>1.6</td>
<td>1-1.9</td>
<td>1.5</td>
<td>0.02</td>
</tr>
<tr>
<td>Chronic renal failure</td>
<td>0.1</td>
<td>0.4</td>
<td>0.7-1.7</td>
<td>1.1</td>
<td>0.4-1</td>
<td>0.6</td>
<td>0.003</td>
</tr>
<tr>
<td>Reintervention</td>
<td>19.7</td>
<td>0.001</td>
<td>0.4-0.8</td>
<td>0.6</td>
<td>0.4-1</td>
<td>0.6</td>
<td>0.003</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.1</td>
<td>0.3</td>
<td>0.8-1.5</td>
<td>1.1</td>
<td>0.8-1.7</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Tibial anastomosis</td>
<td>4.6</td>
<td>0.02</td>
<td>1-2</td>
<td>1.4</td>
<td>0.8-1.7</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Distal procedures</td>
<td>1.7</td>
<td>0.08</td>
<td>0.9-1.7</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run-off score &lt;2</td>
<td>6.4</td>
<td>0.003</td>
<td>1.1-1.9</td>
<td>1.5</td>
<td>0.9-1.6</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Rutherford 5-6*</td>
<td>0.9</td>
<td>0.1</td>
<td>0.9-1.6</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Factors affecting limb salvage at univariate analysis*
<table>
<thead>
<tr>
<th></th>
<th>Male 1 point</th>
<th>Female 2 points</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male 1 point</td>
<td>Female 2 points</td>
<td></td>
</tr>
<tr>
<td>Reintervention</td>
<td>No 1 point</td>
<td>Yes 2 points</td>
<td>-</td>
</tr>
<tr>
<td>Tibial anastomosis</td>
<td>No 1 point</td>
<td>Yes 2 points</td>
<td>-</td>
</tr>
<tr>
<td>Run-off score</td>
<td>2 vessels 2 points</td>
<td>&lt;2 vessels 3 points</td>
<td>-</td>
</tr>
<tr>
<td>Rutherford class</td>
<td>Class 4 1 point</td>
<td>Class 5 2 points</td>
<td>Class 6 3 points</td>
</tr>
</tbody>
</table>

ANOVA test for thrombosis during follow-up found 7.502 as the cut-off score value (p<0.001; R=0.09).
Propaten© Score
Propaten® Score

p=0.08; log rank 3.1

p=0.5; log rank 0.3
Heparin bonded graft could challenge endovascular repair for TASC C-D lesions?

- Surgical bypass still offers better results in terms of primary and secondary patency.

- The same rate of limb salvage in patients with CLI may suggest a first-line endovascular approach in patient at high surgical risk provided that we accept a lower primary patency rate and a higher reintervention rate.
In case of surgical indication

**HB PTFE graft:**

- Good patency and limb salvage rates

- Vein remains the best choice; however, in case of unsuitable vein, heparin bonded PTFE graft is a good alternative with comparable limb salvage rate.
Can we change the paradigm on the basis of the suggested score?

<table>
<thead>
<tr>
<th>Factors</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Procedure</td>
<td>Primary</td>
<td>Redo</td>
</tr>
<tr>
<td>Severity of ischemia</td>
<td>Rest pain</td>
<td>Major tissue loss</td>
</tr>
<tr>
<td>Level of distal anastomosis</td>
<td>Popliteal</td>
<td>Tibial</td>
</tr>
<tr>
<td>Run-off status</td>
<td>$\geq 2$ vessels</td>
<td>$&lt; 2$ vessels</td>
</tr>
</tbody>
</table>

He-bonded Graft

ASV
Can we change the paradigm on the basis of the suggested score?