Hemodynamic Impact of Vein Graft Stenoses and Their Prediction in the Vascular Laboratory

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PURPOSE
To define the direct hemodynamic impact of vein graft stenoses and to correlate peak systolic flow velocity ratios (PSFVR—which is: the velocity within a stenosis/velocity proximal to the stenosis) and blood flow measurements with the preoperative duplex scan.

METHOD
• Preoperative arteriograms confirmed 12 isolated vein graft stenoses, which radiographically ranged from 20% to 83% diameter reduction (mean, 64%).
• At the time of surgery the stenotic graft segment was isolated, and simultaneous pressure and ultrasound transit-time blood flow measurements were recorded for 10 seconds at 200 Hz and were stored on a personal computer-based digital acquisition system.
• The graft stenoses were then repaired with either a vein patch or short interposition graft, and the hemodynamic measurements were repeated.

RESULTS

<table>
<thead>
<tr>
<th>Repair</th>
<th>Mean Flow</th>
<th>Flow Range</th>
<th>Mean Pressure</th>
<th>Pressure Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>45.2 mL/min</td>
<td>4.9 to 140 mL/min</td>
<td>20.4 mm Hg</td>
<td>1.0 to 74.6 mm Hg</td>
</tr>
<tr>
<td>After</td>
<td>104.8 mL/min</td>
<td>1.3 mm Hg</td>
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</table>

• PSFVR recorded in the vascular laboratory correlated significantly with delta P (r = 0.71; p = 0.01) and allowed prediction of delta P as: delta P = 7.4 (PSFVR) - 19.8 and with measured resistance across the stenosis (r = 0.79; p = 0.004).
• Conversely, the angiographic measurement of stenosis did not correlate significantly with these parameters. The angiographic measurement of stenosis showed a moderate correlation with the PSFVR (r = 0.58; p = 0.046).

CONCLUSION
The PSFVR, as measured in the laboratory, is an accurate and useful indicator of the hemodynamic impact of vein graft stenosis. Revision of stenotic vein graft segments resulted in a significant improvement in graft hemodynamics.

TRANSONIC OBSERVATION
This paper was written by a group of well-respected surgeons at a prestigious Boston hospital to support the concept of using hemodynamic parameters (pressure/flow) as indicators of the impact of stenosis on vein grafts found on routine post-op surveillance. The study showed:
• PSFVR is an accurate and reliable indicator of significant graft stenosis. Recommendations are to repair graft stenosis when a PSFVR of 3 to 3.5 is reached.
• The usefulness of intraoperative flow measurements to document adequate repair of isolated areas of stenosis in established grafts.

REFERENCE