ABSTRACT

Objective: To assess the long-term results of re-do surgery for recurrent varicose veins using polytetrafluoroethylene patch interposition to correct a recurrent varicofemoral junction (RVFJ).

Methods: In 170 extremities (137 patients) with RVFJ greater than 3 mm in diameter, re-do surgery was done with patch interposition and without extensive resection of neovascularization. Follow-up data based on physical and ultrasound examinations were obtained for 119 of these extremities (100 patients).

Setting: Private-practice vascular surgery center.

Results: At follow-up (mean, 4.9 years), 5 extremities (4.2%) had another RVFJ. In the 114 extremities with no RVFJ, 27.7% had no varicose veins or incompetent superficial veins, 45.3% had several small varicose veins without reflux, and 22.6% had diffused varicose veins and a new site of incompetence between the deep and superficial venous system.

Conclusions: Re-do surgery using patch interposition lowers the long-term risk of another RVFJ. Wide resection of neovascularization in the groin seems unnecessary.

INTRODUCTION

Recurrence of varicose veins is a serious public health problem,1,2 and the rate of recurrence requiring a re-do procedure after primary surgical treatment of varicose veins is between 20% and 30%.2-3 If re-do surgery is necessary, the groin dissection likely to be required is difficult and associated with considerable morbidity. Moreover, neither closure of the prevascular fascia in front of the femoral vein4-5 nor muscle plasty,6 which is ineffective,7 is feasible in re-do surgery. The only possibility for effective re-do surgery may be interposition of an expanded polytetrafluoroethylene (ePTFE) patch in front of the femoral vein.8-10 This study assessed the long-term results achieved with a patch interposition procedure for re-do varicose vein surgery that was developed to prevent a subsequent recurrence requiring another re-do procedure in the groin.

METHODS

Patients

A total of 137 consecutive patients (170 extremities) underwent re-do surgery with patch interposition for recurrent saphenofemoral incompetence between April 1992 and June 1994. A preliminary report on the procedure used, including its morbidity and short-term results, was published previously.11 All patients had clinically documented recurrent varicose veins classified as C2, C3, or C4 in accordance with the CEAP criteria. In all extremities, the re-do
procedure involved the previous ligation site. All patients underwent Doppler ultrasonography (done by the same technician) before the procedure and 1 month afterward. The postoperative imaging was done to confirm that the varicose veins had been excised completely and to assess the status of the femoral vein (ie, to examine the anterior aspect and confirm the absence of fluid accumulation in the subcutaneous tissue). Preoperative marking was done with use of a Doppler ultrasound study of the femoral region (Hitachi EUB 555 [7.5 Mhz] transducer, Ecoscan, Les Ulis, France; and Esaote AU 530 [10 Mhz] transducer, Biomedica, Leperreux, France). All patients presented with a residual stump (diameter > 3 mm) in the area of the saphenofemoral junction (on the anterior or medioanterior aspect of the femoral vein) and reflux greater than 1 second measured during pumping of the calf muscle. A recurrent varicofemoral junction (RVFJ) provided a connection between the femoral vein and either inguinal or inguinofemoral varicose veins or the residual saphenous trunk. Indications for re-do surgery were based on the extent of the connection between the femoral vein and varicose veins as determined by using Doppler ultrasonography. Routine assessment for deep-vein insufficiency was not done. A residual or newly formed connection between the femoral vein and inguinal veins without reflux was not considered an indication for a re-do operation.

For 98 extremities, the re-do procedure was done for a first recurrence; for the other 21, 2 to 4 previous re-do operations had been done for a second to fourth recurrence, with at least one re-do procedure on the former saphenofemoral junction. Seven of the previous re-do operations were performed by the same surgeon (D.C.), who employed a technique formerly used routinely (general anesthesia, transincisional approach, wide dissection of the femoral vein, and removal of the stump), and 14 were done by other surgeons (technique not recorded).

**Surgical technique**

The re-do surgical procedures were done with the patient under locoregional anesthesia, with a femoral nerve block, injection of 50% lidocaine solution (1%) to extend the area of anesthesia to residual varicose veins, and if requested by the patient, injection of midazolam and alfentanil for sedation and pain control. Eighty-two percent of patients chose to be treated as outpatients; the others were discharged the day after surgery.

The operation was done by using a method similar to that employed in endoscopic procedures, with a lateral approach involving an incision placed at a distance remote from the femoral vein and minimal tunnel dissection to expose the stump of the tied vein. A 4-cm oblique lateral skin incision was made, with the medial end above the residual stump that had been marked preoperatively with use of Doppler scanning. Dissection directly to the femoral vein was accomplished by using binocular loupes without an electric scalpel. The vascular sheath was opened, and the residual stump was dissected by raising the prevascular flap forward. After initial suture ligation of the stump flush with the femoral vein, dissection was continued distally to the division branches of the residual stump. Collaterals were divided after placement of clips. If present, the isolated trunk or residual great saphenous trunk was pre-tied for stripping. Obliteration of the stump was achieved by burying it under its lumen with a back-and-forth suture, laying the stump over the adventitia of the femoral vein.

A partition was made between the stump suture and the tied collaterals in the prevascular subcutaneous tissues by interposing an ePTFE patch (0.1 mm thick, 1 cm long, and 1.5 cm
wide; Preclude Peritoneal Membrane, W.L. Gore & Associates, Flagstaff, Arizona, USA). The patch was attached by applying biological glue under it and in the dissection space. To facilitate placement and avoid displacement of the patch, the dissection space was made as obliquely and as small as possible. No suction drains were inserted. The incision was closed with intradermal resorbable sutures.

Incompetent residual saphenous trunks and collateral trunks were stripped with a Pin-Stripper (Tüscher, Berne, Switzerland). Varicose veins were removed with Muller avulsion hooks inserted through phlebectomy incisions. Postoperative compression was achieved by applying double class II stockings for 3 days followed by single class II elastic compression for 1 month. No antibiotic therapy was given. Postoperative injection sclerotherapy was not prescribed for any patient, but 25 did have a few injections; compliance with this treatment was poor.

Follow-up study

Starting in February 1997, all patients who had undergone re-do surgery for recurrent varicose veins were contacted and asked to undergo a follow-up evaluation including a physical examination and Doppler ultrasound study. The assessed extremities of patients who underwent this evaluation were initially classified into 2 categories: (1) poor results or failure of re-do surgery, with an incompetent refluxing RVFJ having a diameter greater than 3 mm at the stump of the tied vein, theoretically requiring another re-do procedure in the groin; and (2) good results indicated by the absence of RVFJ in the groin and by the femoral vein's showing a smooth anterior or medial aspect and no stump. The presence of a single visible or palpable varicose vein, even if only a few centimeters long, was considered evidence of ongoing varicose veins. A new insufficient communication between the deep and superficial system was sought for in the thigh, calf, and popliteal fossa.

RESULTS

The female patients had undergone a mean of 2.5 pregnancies before the re-do varicose vein surgery. Between 1997 and 1999, 100 patients (90 women and 10 men; mean age, 53.5 years; range, 26-72 years) had 119 extremities (61 right legs and 58 left legs) examined in the follow-up study. The mean time between re-do surgery and follow-up was 4.9 years (range, 3 to 7 years).

At follow-up, 114 extremities showed good results (no RVFJ in the groin). Within this group, 33 extremities (27.7%) had no varicose or incompetent veins; 54 (45.3%) had one or several small varices, without reflux from deep to superficial system, requiring phlebectomy or sclerotherapy only; and 27 (22.6%) had diffused varicose veins with a new insufficient communication between the deep and superficial system (perforators or short saphenous insufficiency). Only 5 extremities (4.2%) had poor results, with varices and a new RVFJ in the same site as previously and theoretically requiring another re-do procedure in the groin. Two of the 5 failures occurred in obese patients, including the only patient who had an abscess (on postoperative day 6). This patient has not yet undergone reoperation. Another failure was due to insufficient resection. One of the extremities with failure had exclusively inguinal varicose veins, whereas the other 4 had varicose veins in the groin, thigh, and leg. One patient with a new RVFJ had a perforating...
vein of the thigh, another had recurrent popliteal varicose veins after surgery on the short saphenous vein, and 2 had incompetent translymphatic veins.

In 10 extremities, one or more incompetent tortuous inguinal veins (3-6 mm in diameter) were observed in front of, but not connected to, the femoral vein. Similar findings were noted in 2 other extremities, except that the veins were competent. On ultrasonography, the ePTFE patch was visualized in a vertical position in front of the femoral vein, serving as a barrier between that vein and the tortuous veins.

Ten patients with varices at follow-up had previously undergone a re-do procedure. The 10 procedures had involved a perforating vein of the popliteal fossa (2 patients), an incompetent short saphenous vein (1 patient), an incompetent perforating vein in the thigh (1 patient), and phlebectomy incisions (6 patients).

**DISCUSSION**

Re-do surgery for incompetence of the great saphenous vein is challenging. In 67% of cases, dissection in the groin is required to achieve disconnection of an RVFJ corresponding to a residual communicating femoral branch with or without neovascularization. Various approaches have been described for exposure of the tied stump at re-do, including the superior, medial, lateral approach. Although the goal with all approaches is to avoid the cicatricial zone, we prefer the lateral approach because it provides the greatest distance from both the cicatricial zone and the lymph nodes. Frequent location of the tied stump on the anteromedial side of the femoral vein did not hamper the exposure achieved with this approach.

The reported rate of neovascularization as the cause of recurrence after primary varicose vein surgery ranges from 4% to 52% (Table 1). This variability is due to differences in methods used to identify neovascularization. Most evidence is based on radiologic, ultrasound, or surgical findings. The only clinicopathological criterion for identifying neovascularization was proposed by Nyamekye et al., who used immunohistochemical staining with S100 protein to demonstrate absence of transparietal nerves in the walls of the new vessels.

The findings in our patients indicate that the term "neojunction" may be more accurate than "neovascularization," since a direct connection with the femoral vein was not found when new vessel formation was present. The neojunction was located on the anteromedial aspect of the femoral vein at the same place the original saphenofemoral junction had been. In our series, the surgical procedure always included division and ligation of the residual stump flush with the femoral vein, regardless of the stump's length, and the stump was always left in smooth continuity with the adventitia of the femoral vein. Thus, the neovascularization that occurred reflected a newly formed network of communicating veins that appeared to establish a connection between the stump and residual varicose veins in the thigh or incompetent residual saphenous vein trunk. No conclusive evidence that such vessels are new has been provided. Alternative explanations are that these vessels develop from pre-existing veins or correspond to hypertrophy of lymph node vessels.

The rationale for placing an ePTFE patch in front of the femoral vein is that after division and
ligation of the residual stump, the 2 vein sections will come into direct contact with each other when the incision is closed and the patch will provide a barrier between two vein ligations. We secure the patch with biological glue rather than sutures to avoid additional trauma and to facilitate removal of the patch in case of infection (although, in our series, patch removal was not required in any patient, including the one in whom an abscess developed). The long-term results (mean follow-up period, 4.9 years) with our technique were satisfactory: only 4.2% of extremities had RVFJ warranting another re-do procedure. This percentage is lower than those previously reported 9,18,21,25 (Table 2).

The low rate of neovascularization in our series indicates that healing is a major factor in vessel formation. Our technique was designed to minimize operative trauma. The femoral vein was exposed by placing a lateral incision directly under the prevascular fascia, without passage through the lymph node layer, extensive tissue excision or dissection, or use of an electric scalpel or drains. Actually no patient had postoperative lymphorrhrea, lymphoedema, or hematoma, and only one patient, who was obese, had a postoperative abscess. This obese patient and the 2 most obese patients in the series (body-mass indices > 33) were among those with poor results and RVFJ. An association between neovascularization and postoperative wound complications (hematoma or abscess) is often reported.21

More support for the idea that operative trauma is involved in inducing neovascularization is provided by comparative studies showing a lower risk of neovascularization after primary varicose vein surgery than after re-do surgery, a much more invasive procedure that requires more extensive dissection. Neovascularization has been reported to occur at a rate of 14% after primary surgery and of 40% after re-do surgery (p = 0.02).9 The recurrence rate for varicose veins is also higher after re-do surgery 3,9: one study9 found a 14% rate after primary surgery and a 47% rate after re-do procedures (p = 0.006).

Whereas neovascularization may be related to healing in hematoma zones or lymph node layers, incompetence can occur only in the presence of incompetent residual thigh veins or saphenous trunks. Thus, the neovascularization networks apparently continue to develop over time21 but do not become incompetent and pathologic unless they connect with incompetent superficial veins in the thigh. Some studies 18 have shown that inguinal neovascularization is more common in patients with clinical recurrences characterized by new vessels with large diameters (> 4 mm), but no study has quantified the influence of neovascularization on clinical recurrence of varicose veins.

In summary, in the light of previous studies showing that neovascularization after varicose vein surgery is consistently associated with aspects of the surgical technique, including extensive excision in the groin through a wide subcutaneous approach, exposure of the femoral vein, and en bloc removal of scar tissue, we developed a less invasive technique involving division and ligation of the varicofemoral connection and interposition of an ePTFE patch. Our good long-term results are likely due to placement of the patch flush with the femoral vein and extensive excision of varicose veins, residual saphenous trunks, and collaterals while leaving intermediate areas intact. Comparative studies are needed to evaluate the relative contributions of patch interposition and division without extensive dissection of the femoral area to these results. However, our findings suggest that by containing neovascularization, use of an ePTFE patch reduces the risk of RVFJ and, hence, the need for a subsequent re-do procedure.
ACKNOWLEDGEMENTS

This study was supported by the Suisse Society of Phlebology.

REFERENCES

- De Maeseneer MG, Tielliu IF, Van Schil PE, De Hert SG, Eyksens EJ. Clinical relevance of neovascularisation on duplex ultrasound in the long-term follow-up after varicose vein


**Table 1**

<table>
<thead>
<tr>
<th>Study (year)</th>
<th>No. of patients</th>
<th>Assessment method</th>
<th>Follow-up (years)</th>
<th>Recurrence rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khaira et al17 (1966)</td>
<td>190</td>
<td>CDU</td>
<td>Not given</td>
<td>49</td>
</tr>
<tr>
<td>Jones et al10 (1996)</td>
<td>139</td>
<td>CDU</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>De Maeseneer et al18 (1999)</td>
<td>106</td>
<td>CDU</td>
<td>4.6</td>
<td>45</td>
</tr>
<tr>
<td>De Maeseneer et al21 (1997)</td>
<td>177</td>
<td>CDU</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Glass8 (1998)b</td>
<td>141</td>
<td>Surgical exploration</td>
<td>&gt;4</td>
<td>25</td>
</tr>
<tr>
<td>Turton et al19 (1999)</td>
<td>46</td>
<td>CDU</td>
<td>1</td>
<td>4.3</td>
</tr>
<tr>
<td>Sarin et al20 (1994)</td>
<td>90</td>
<td>CDU</td>
<td>1.7</td>
<td>14</td>
</tr>
</tbody>
</table>

a: CDU indicates color duplex ultrasonography.
b: Patients were seen in 1951 to 1958.

**Table 2**
Studies reporting recurrent varicofemoral junction or neovascularization in the groin resulting in a new connection between the femoral vein and inguinal varicose veins after re-do varicose vein surgery done with or without patch interposition.

<table>
<thead>
<tr>
<th>Surgery type/study (year)</th>
<th>No. of patients</th>
<th>Follow-up (years)</th>
<th>Recurrence rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Re-do without patch</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>De Maeseneer et al21 (1997)</td>
<td>14</td>
<td>1</td>
<td>21.4</td>
</tr>
<tr>
<td>De Maeseneer et al18 (1999)</td>
<td>11</td>
<td>4.6</td>
<td>63.6</td>
</tr>
<tr>
<td><strong>Re-do with patch</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnshaw et al9 (1998)</td>
<td>15</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Bhatti et al25 (2000)</td>
<td>70</td>
<td>1.5</td>
<td>12</td>
</tr>
<tr>
<td>Creton (current series)</td>
<td>119</td>
<td>4.9</td>
<td>4.2</td>
</tr>
</tbody>
</table>