

Original Article

Surgery for Recurrent Sapheno-femoral Incompetence Using Expanded Polytetrafluoroethylene Patch Interposition in Front of the Femoral Vein: Long-Term Outcome in 119 Extremities

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ABSTRACT

Objective: To assess the long-term results of re-do surgery for recurrent varicose veins using polytetrafluoroethylene patch interposition to correct a recurrent varico-femoral 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 neovascularisation. Follow-up data based on physical and ultrasound examinations were obtained for 119 of these extremities (100 patients).

Setting: Private-practice vascular surgery centre.

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 neovascularisation in the groin seems unnecessary.

Keywords: Expanded polytetrafluoroethylene; Great saphenous vein; Neovascularisation; Recurrent varicose veins; Venous incompetence

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 vein [4,5] 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.

Materials and Methods

Patients

A total of 137 consecutive patients (170 extremities) underwent re-do surgery with patch interposition for recurrent sapheno-femoral 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 afterwards. The postoperative imaging was done to confirm that the varicose veins had been excised completely and to assess the status of the femoral vein (i.e. 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 sapheno-femoral junction (on the anterior or medioanterior aspect of the femoral vein) and reflux greater than 1 s measured during pumping of the calf muscle. A recurrent varico-femoral junction (RVFJ) provided a connection between the femoral vein and either inguinal or inguino-femoral 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, two to four previous re-do operations had been done for a second to fourth recurrence, with at least one re-do procedure on the former sapheno-femoral junction. Seven of the previous re-do operations were performed by the same surgeon (D.C.), who employed a technique formerly used routinely (general anaesthesia, 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 anaesthesia, with a femoral nerve block, injection of 50% lidocaine solution (1%) to extend the area of anaesthesia to residual varicose veins and, if requested by the patient, injection of midazolam and afentanil for sedation and pain control. Eighty-two per cent of patient chose to be treated as outpatients; the others were discharged the day after surgery.

The operation was done 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 the 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, 1.5 cm wide; Preclude Peritoneal Membrane, W.L.Gore & Associates, Flagstaff, AZ). 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 two 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 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 centimetres long, was considered evidence of continuing 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, 10 men; mean age 53.5 years, range 26–72 years) had 119 extremities (61 right legs, 58 left legs) examined in the follow-up study. The mean time between re-do surgery and follow-up was 4.9 years (range 3–7 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 of 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 visualised 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 [12] to achieve disconnection of an RVFJ corresponding to a residual communicating femoral branch with or without neovascularisation. Various approaches have been described for exposure of the tied stump at re-do, including the superior [13], medial [6,14,15] and lateral [16] 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 neovascularisation as the cause of recurrence after primary varicose vein surgery ranges from 4% to 52% [8,10,17–21] (Table 1). This variability is due to differences in methods used to identify neovascularisation. Most evidence is based on radiological, ultrasound or surgical findings. The only clinicopathological criterion for identifying neovascularisation was proposed by Nyamekye et al. [22], who used immunohistochemical staining with S100 protein to demonstrate absence of transperitonal nerves in the walls of the new vessels.

The findings in our patients indicate that the term ‘neojunction’ may be more accurate than ‘neovascularisation,’ 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 sapheno-femoral 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 neovascularisation 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

Table 1. Studies reporting recurrent varico-femoral junction or neovascularisation in the groin resulting in connection between the femoral vein and inguinal varicose veins or residual saphenous trunks after primary varicose vein stripping

Study	Year	No. of patients	Assessment method	Follow-up (years)	Recurrence rate (%)
Khaira et al. [17]	1966	190	CDU	Not given	49
Jones et al. [10]	1996	139	CDU	2	52
De Maeseneer et al. [18]	1999	106	CDU	4.6	45
De Maeseneer et al. [21]	1997	177	CDU	1	14
Glass [8]	1998 ^a	141	Surgical exploration	>4	25
Turton et al. [19]	1999	46	CDU	1	4.3
Sarin et al. [20]	1994	90	CDU	1.7	14

CDU, colour duplex ultrasonography.

^a Patients were seen in 1951 to 1958.

Table 2. Studies reporting recurrent varico-femoral junction or neovascularisation 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

Surgery type/study	Year	No. of patients	Follow-up (years)	Recurrence rate (%)
<i>Re-do without patch</i>				
De Maeseneer et al. [21]	1997	14	1	21.4
De Maeseneer et al. [18]	1999	11	4.6	63.6
<i>Re-do with patch</i>				
Earnshaw et al. [9]	1998	15	1	40
Bhatti et al. [25]	2000	70	1.5	12
Creton (current series)		119	4.9	4.2

new has been provided. Alternative explanations are that these vessels develop from pre-existing veins [12,23] or correspond to hypertrophy of lymph node vessels [24].

The rationale for placing an ePTEE patch in front of the femoral vein is that after division and ligation of the residual stump, the two 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 neovascularisation in our series indicates that healing is a major factor in vessel formation. Our technique was designed to minimise 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. No patient had postoperative lymphorrhoea, lymphoedema or haematoma, 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 index $>33 \text{ kg/m}^2$) were among those with poor results and RVFJ. An association between neovascularisation and postoperative wound complications (haematoma or abscess) is often reported [21].

More support for the idea that operative trauma is involved in inducing neovascularisation is provided by comparative studies showing a lower risk of neovascularisation after primary varicose vein surgery than after re-do surgery, a much more invasive procedure that requires more extensive dissection. Neovascularisation 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 study [9] found a 14% rate after primary surgery and a 47% rate after re-do procedures ($p = 0.006$).

Whereas neovascularisation may be related to healing in haematoma zones or lymph node layers, incompetence can occur only in the presence of incompetent residual thigh veins or saphenous trunks. Thus, the neovascularisation networks apparently continue to develop over time [21] but do not become incompetent and pathological unless they connect with incompetent superficial veins in the thigh. Some studies [18] have shown that inguinal neovascularisation is more common in patients with clinical recurrences characterised by new vessels with large diameters ($>4 \text{ mm}$), but no study has quantified the influence of neovascularisation on clinical recurrence of varicose veins.

In summary, in the light of previous studies showing that neovascularisation 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 varico-femoral connection and interposition of an ePTFE patch. Our good long-term results are probably 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 neovascularisation, use of an ePTFE patch reduces the risk of RVFJ and, hence, the need for a subsequent re-do procedure.

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References

1. Negus D. Recurrent varicose veins: a national problem. *Br J Surg* 1993;80:823–4.
2. Perrin MR, Guex JJ, Ruckley CW, et al, and the REVAS group. Recurrent varices after surgery (REVAS), a consensus document. *Cardiovasc Surg* 2000;8:233–45.
3. Darke SG. The morphology of recurrent varicose vein. *Eur J Vasc Surg* 1992;6:512–7.

4. Glass GM. Prevention of recurrent saphenofemoral incompetence after surgery for varicose veins. *Br J Surg* 1989;76:1210.
5. Glass GM. Neovascularization in recurrence of varices of the great saphenous vein in the groin: surgical anatomy and morphology. *Vasc Surg* 1989;23:435-42.
6. Sheppard M. A procedure for the prevention of recurrent saphenofemoral incompetence. *Aust N Z J Surg* 1978;48:322-6.
7. Gibbs PJ, Foy DM, Darke SG. Reoperation for recurrent saphenofemoral incompetence: a prospective randomised trial using a reflected flap of pectineus fascia. *Eur J Vasc Endovasc Surg* 1999;18:494-8.
8. Glass GM. Prevention of sapheno-femoral and sapheno-popliteal recurrence of varicose veins by forming a partition to contain neovascularization. *Phlebology* 1998;13:3-9.
9. Earnshaw JJ, Davies K, Harradine K, Heather BP. Preliminary results of PTFE patch saphenoplasty to prevent neovascularization leading to recurrent varicose veins. *Phlebology* 1998;13:10-3.
10. Jones L, Braithwaite BD, Selwin D, Cooke S, Earnshaw JJ. Neovascularization is the principal cause of varicose vein recurrence: results of a randomised trial of stripping the long saphenous vein. *Eur J Vasc Endovasc Surg* 1996;12:442-5.
11. Creton D. Prosthetic material interposition on the crosssectomy stump in varicose vein recurrence surgery: preliminary report on the prevention of angiogenesis. *Scripta Phlebol* 1998;6:4-7.
12. Stonebridge PA, Chalmers N, Beggs I, Bradbury AW, Ruckley CW. Recurrent varicose veins: a varicographic analysis leading to a new practical classification. *Br J Surg* 1995;82:60-2.
13. Eklof B, Juhan C. Recurrence of primary varicose veins. In: Eklof B, Gores JE, Thulesius O, Bergquist O, editors. *Controversies in the management of venous disorders*. London: Butterworth, 1989:220-33.
14. Greaney MG, Makin GS. Operation for recurrent saphenofemoral incompetence using a medial approach to the saphenofemoral junction. *Br J Surg* 1985;72:910-1.
15. Darke SG. Recurrent varices. In: Ballard JL, Bergan JJ, editors. *Chronic venous insufficiency: diagnosis and treatment*. Berlin Heidelberg New York: Springer, 2000:79-92.
16. Belardi P, Lucertini G. Advantages of the lateral approach for re-exploration of the sapheno-femoral junction for recurrent varicose veins. *Cardiovasc Surg* 1994;2:772-4.
17. Khaira HS, Parnell A, Crowson MC. Colour flow duplex in the assessment of recurrent varicose veins. *Ann R Coll Surg Engl* 1996;78:139-41.
18. De Maeseneer MG, Tielliu IF, Van Schil PE, De Hert SG, Eyksens EJ. Clinical relevance of neovascularization on duplex ultrasound in the long-term follow-up after varicose vein operation. *Phlebology* 1999;14:118-22.
19. Turton EPL, Scott DJ, Richards SP, et al. Duplex-derived evidence of reflux after varicose vein surgery: neoreflux or neovascularisation? *Eur J Vasc Endovasc Surg* 1999;17:230-3.
20. Sarin S, Scurr JH, Coleridge Smith PD. The outcome of sapheno-femoral junction ligation: is the operation good enough? [abstract]. *Phlebology* 1994;9:127.
21. De Maeseneer MG, Ongena KP, Van den Brande F, Van Schil PE, De Hert SG, Eyksens EJ. Duplex ultrasound assessment of neovascularisation after saphenofemoral or sapheno-popliteal junction ligation. *Phlebology* 1997;12:64-8.
22. Nyamekye I, Shephard A, Davies B, Heather P, Earnshaw JJ. Clinicopathological evidence that neovascularization is a cause of recurrent varicose veins. *Eur J Vasc Endovasc Surg* 1998;15:412-5.
23. Labropoulos N, Touloupakis E, Giannoukas AD, Leon M, Katsamouris A, Nicoloides AN. Recurrent varicose veins: investigation of the pattern and extent of reflux with color flow duplex scanning. *Surgery* 1996;119:406-9.
24. Lemasles P, Uhl JF, Lefebvre Vilardebo M, Baud JM, Gillot C. Veines lympho-ganglionnaires inguinales. Aspects anatomiques et échographiques. Conséquences sur la définition de la néogenèse. Conséquences thérapeutiques. *Phlébologie* 1999; 52:163-9.
25. Bhatti TS, Whitman B, Harradine K, Cooke SG, Heather BP, Earnshaw JJ. Causes of re-currence after polytetrafluoroethylene patch saphenoplasty for recurrent varicose veins. *Br J Surg* 2000;87:1356-60.

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