
A Nondraining Saphenous System Is a Factor of Poor Prognosis for Long-Term Results in Surgery of Great Saphenous Vein Recurrences

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OBJECTIVE. The objective was to examine the evolution of superficial venous disease after the suppression of every principal or accessory saphenous trunk.

METHODS. To achieve this aim, the long-term results of complete ablation of saphenous trunks and varicose veins during redo surgery for recurrent great saphenous veins have been assessed. Of 170 extremities (137 patients), 4.9 years of follow-up data based on physical and ultrasound examinations were obtained for 119 extremities (100 patients).

RESULTS. No varicose veins could be observed for 27.7% of extremities. For 45.3% diffuse varicose veins without reflux between the deep and superficial system could be observed. For 26.8% varicose veins and a new reflux had developed between

the deep and superficial venous system. After 5 years, recurrent varicose veins were significantly associated, before operation, with the absence of insufficient residual saphenous trunk and with the presence of diffuse varicose veins ($p = 0.015$) and, during redo surgery, with a higher number of phlebectomy incisions ($p = 0.02$).

CONCLUSIONS. The absence of superficial venous drainage (complete removal of varicose veins and saphenous trunk) leads to appearance of rerecurrences in the surgery of great saphenous vein recurrences, 72.3% of the cases show still new varices at the 5-year follow-up. This poor prognosis probably suggests the presence of a nondraining superficial venous system.

DENIS CRETON, MD HAS INDICATED NO INTEREST WITH COMMERCIAL SUPPORTERS.

THE ORIGIN and spontaneous evolution of varicose vein disease are still controversial. Classically the start point could be an insufficient saphenofemoral or saphenopopliteal junction but it could be an isolated insufficient tributary.¹ The origin of lower limb venous reflux appears to be a local or multifocal process.² Actually the most important cause may involve a genetic lack or dysfunction of endothelial peptidic receptor.³⁻⁵ The symptoms appear after the deterioration of the hemodynamic balance, which has itself been generated by the damaging of the venous wall. Classically many recurrences result from a lack of removal concerning the saphenous trunk, the varicose veins, or the communications between deep and superficial venous system. But, sometimes, 10 years later, the side that has been conventionally well operated on is surprisingly often worse than the nonoperated on side. Recurrences may result from the suppression of a venous way (e.g., iatrogenic or postthrombotic stenosis of the femoral vein). Some authors⁶ have demonstrated that varicose vein surgery

could generate new varicose veins especially when leaving a nondraining residual trunk, which means leaving a saphenous trunk that cannot drain into the deep venous system either by a residual junction when the flux is upward or by a reentry perforator when there is a reflux.

Few series have studied the evolution of a saphenous system deprived of any saphenous trunks or tributaries. To study this special hemodynamic situation, we have chosen to assess the long-term results obtained after a complete removal of the saphenous trunk and varicose veins in the case of redo varicose vein surgery located on the great saphenous area. The aim was to study the spontaneous evolution of a type of experimental nondraining great saphenous system.

Methods

Patients

Between 1992 and 1994 a total of 137 consecutive patients (170 extremities), who had previously undergone a flush ligation and a stripping of the GSV, underwent a redo surgery consisting, at the same time, of a reoperation for recurrent saphenofemoral incom-

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petence, complete ablation of varicose veins, and stripping of the residual saphenous trunks. No documentation or postoperative records were available to say nothing of data about pre- and postoperative exams.

These patients were retrospectively classified from clinical records as C2, C3, or C4 in accordance with the CEAP criteria. Patients showing previous deep venous thrombosis or clinical signs of deep venous insufficiency were excluded as well as patients with insufficient short saphenous vein. Each patient underwent a Doppler ultrasonography (performed by the same technician) before the procedure. Preoperative marking was performed with the 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 the patients showed a residual stump in the area of the saphenofemoral junction corresponding to an incomplete removal of the previous saphenofemoral junction. This new connection showed a reflux exceeding 1 s, calculated during the pumping of the calf muscle. A recurrent varicofemoral junction (new communication between the femoral vein and varices or superficial veins) (Figure 1) provided a connection between the femoral vein and an insufficient residual saphenous trunk or accessory saphenous trunk. The definition of residual trunk was, indifferently the genuine trunk in its anatomical subfascial position⁷ or an accessory saphenous trunk.

The patients who had undergone a redo procedure showed one of the following anatomical types of recurrence (Figure 2): *type 1*, presence of a saphenous trunk with a direct connection to the femoral vein by means of a residual stump (junction through a tributary or intact saphenofemoral junction); *type 2*, presence of a saphenous trunk with an indirect connection to the femoral vein by means of newly formed vessels in the groin; *type 3*, presence of an isolated saphenous trunk with the proximal end not connected to the incompetent residual stump; and *type 4*, presence of a residual stump associated with diffuse varicose veins. The first three types showed a residual saphenous or accessory trunk, whereas type 4 showed only diffused varicose veins. Considering the very low rate of C3/C4, the absence of C5/C6, and the absence of clinical sign and history of deep venous thrombosis routine assessment for deep-vein insufficiency was not carried out.

Surgical Technique

Surgical procedures were performed under locoregional anesthesia with a femoral nerve block, injection of

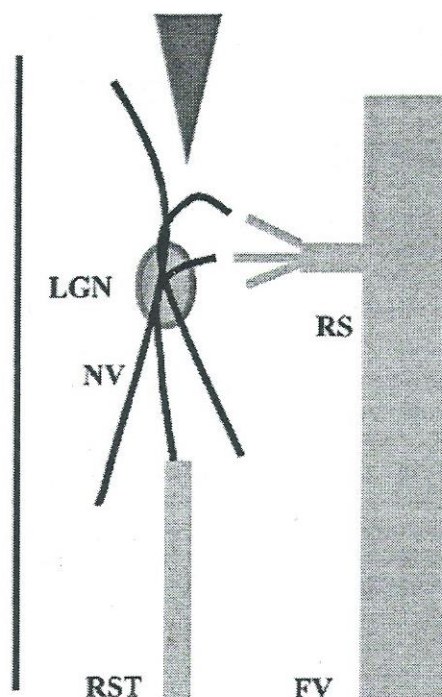


Figure 1. Neovascularization (NV) corresponds to a venous network located in the groin, passing sometimes through lymphatic nodes (LGN) and connected with abdominal subcutaneous veins, deep veins, insufficient residual stump (RS), and insufficient residual saphenous trunk (RST).

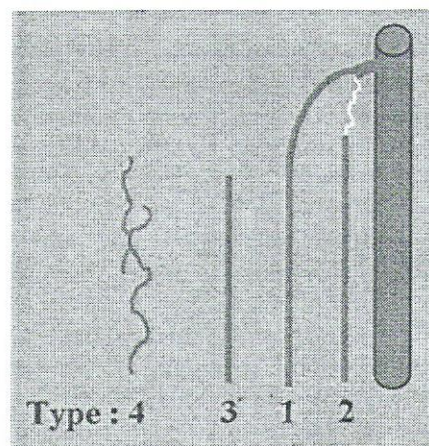


Figure 2. Classification of the anatomical types of recurrences: type 1, saphenous trunk with a direct connection to the femoral vein by means of a residual stump (junction or collateral of the intact saphenofemoral junction); type 2, saphenous trunk with an indirect connection to the femoral vein by means of newly formed vessels in the groin; type 3, isolated saphenous trunk with the proximal end not connected to the incompetent residual stump; and type 4, residual stump associated with diffuse varicose veins.

50% lidocaine solution to extend the area of anesthesia to the residual varicose veins, and, if requested by the patient, an injection of midazolam and alfentanil for sedation and pain control. It was a

always unilateral procedure. Eighty-two percent of patients chose to be treated as outpatients.

The operation was carried out using a lateral approach to expose the stump, as previously described, with suture ligation of the stump and burying it with a back-and-forth suture of the femoral vein adventitia. A partitioning was achieved by interposition of an ePTFE patch (W. L. Gore & Associates, Flagstaff, AZ).⁸ Incompetent residual saphenous trunks and accessory trunks were stripped with a pin stripper (Tüscher, Berne, Switzerland) always on the thigh, never below knee. During the same operation, varicose veins were totally removed with Muller avulsion hooks inserted through phlebectomy incisions. The number of phlebectomy incisions was recorded for each operation. Insufficient perforators connected to the varicose network were removed by means of phlebectomies. Postoperative compression was achieved by applying double class II stockings for 3 days followed by single class II elastic compression for 1 month. No patients were proposed postoperative injection sclerotherapy; however, 25 of them chose it but compliance was poor.

Follow-up Study

One month later a second postoperative imaging was carried out to verify that the varicose veins as well as the residual trunk had been completely removed. All the patients who had undergone redo surgery for recurrent varicose veins since 1997 were asked to undergo a physical examination and a Doppler ultrasound study. After these tests, they were classified into two categories (Figure 3): type A, absence of varicose veins (C0, C1 of the CEAP classification); and type B, presence of varicose veins (C2 of the CEAP classification). The extremities with type B results were divided into two subgroups:

- First, type B1: presence of visible or palpable varicose veins, exceeding 3 mm in diameter, but no reflux from the deep to the superficial veins (i.e., no reflux when performing Valsalva maneuvers and when compressing and decompressing the calf). They were venovenous shunt type R3, according to the definition by Cappelli et al.,⁶ that is, neovessels bridging the R2–R2 or R3–R3 ligature or the R2–R3 or R2–R4 compartments. The presence of a single varicose vein, even a few centimeters long, in any area—perineal, inguinal, femoral, calf, or popliteal—was considered as evidence of ongoing varicose disease in that area.
- Second, type B2: presence of varicose veins and of another incompetent connection between the deep and superficial network with reflux during calf compression and decompression (new recurrent

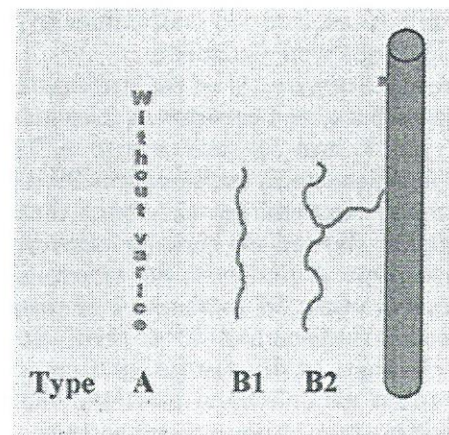


Figure 3. Classification of the results at follow-up: type A, absence of varicose veins (C0, C1 of the CEAP classification); type B1, presence of visible or palpable varicose veins, exceeding 3 mm in diameter, but no reflux from the deep to the superficial veins (i.e., no reflux when performing Valsalva maneuvers and when compressing and decompressing the calf) (C2 of the CEAP classification); and type B2, presence of varicose veins and of another incompetent connection between the deep and superficial network (C2 of the CEAP classification).

varicofemoral junction, incompetent femoral perforating vein, or incompetent small saphenous vein). These varices corresponded to a new venovenous shunt, that is, neovessels bridging the R1–R2 or R1–R3 compartments.⁹

Data from all these patients were recorded and compiled. Statistical analyses using chi-square tests were made to evaluate first, the relation between recurrence of varicose veins 5 years after redo surgery and their location on the lower extremity (contiguous areas, groin–thigh and thigh–calf; and noncontiguous areas, groin–calf); second, the relations between 5-year follow-up results, patients' ages, and the number of pregnancies in female patients; and third, the relations between the anatomical type of 5-year follow-up new recurrence and the number of phlebectomy incisions during redo surgery. A *p* value of less than 0.05 was considered to represent statistical significance.

Results

Between 1997 and 1999, in the context of this follow-up study, 100 patients were examined (90 women and 10 men; mean age 53.5 years, range 26–72 years). Female patients had undergone an average of 2.5 pregnancies before redo varicose vein surgery. No patients were pregnant after redo surgery. No patients had vulvar or perineal veins suggesting the presence of ovarian vein incompetence. The average period of time between redo surgery and follow-up is 4.9 years (range

3–7 years). A total of 119 extremities (61 right legs and 58 left legs) were examined.

Before redo surgery, 34 of the extremities had been classified with a type 1 recurrence, 23 with a type 2, 4 with a type 3, and 58 with a type 4. The average number of phlebectomy incisions was 39.9 (range 5 to 92). For 33 extremities (27.7%), the follow-up examinations showed no varicose veins or incompetent veins (type A findings); 86 extremities showed new varicose veins, 54 extremities of them (45.3%) with type B1 findings and 32 of them (26.8%) with type B2 findings. In this last group 5 cases showed a new recurrent varicofemoral junction. The follow-up examinations showed no saphenous trunk.

Table 1 shows the locations of new varicose veins according to the type of follow-up findings. Statistical analysis revealed that recurrence of varicose veins after redo surgery was less likely to appear in two non-contiguous areas (groin vs. lower leg, $p = 0.023$) than in two contiguous areas (groin vs. thigh, $p = 0.001$; thigh vs. lower leg, $p = 0.001$). The presence of varicose veins in contiguous areas (thigh and lower leg) was linked to the presence of varicose veins in the groin ($p = 0.002$ when groin varicose veins were present and $p = 0.012$ when they were absent).

In the follow-up examinations (type A findings), no correlations could be established between the absence

of varicose veins and either the patients' ages ($p = 0.221$) or the number of previous pregnancies ($p = 0.883$). Conversely, the presence of varicose veins after redo surgery at follow-up (types B1 and B2) was significantly associated with both type 4 preoperative recurrence ($p = 0.015$) and a greater number of phlebectomy incisions during redo surgery ($p = 0.02$) (Table 2).

Patients who showed a residual insufficient saphenous trunk before redo (types 2 and 3) were significantly correlated with patients with good result showing no varicose veins at the follow-up examinations (type A) (Table 2).

Of the 81 patients with type B1 or B2 findings after redo surgery, 10 of them had undergone another redo procedure (two perforators of the popliteal fossa, one incompetence of a short saphenous vein, one incompetent thigh perforator, and six phlebectomies).

Discussion

The residual saphenous trunks found when recurrences occur must be missed saphenous trunks of first surgery. Retrospectively, the differentiation between a normal subfascial trunk, an accessory extrafascial trunk, and a bifid saphenous trunk¹⁰ is difficult to establish. The complete removal of the superficial venous system (trunk, tributaries, and varicose veins) in the area of the great saphenous vein could not prevent the new development of varicose veins from happening in this area.

If we consider that the "no varicose veins" result criteria are the same in this study as in Cappelli et al.,⁶ long-term results of a complete truncular and varicosis ablation are not better than those obtained with the CHIVA method where a saphenous draining residual trunk is left (27% of the patients without varicose veins at follow up vs. 41.2% with the CHIVA method). The spreading of the varicose network and the progression of new vessels without reflux from deep to superficial veins can be considered as either signs of severe varicose disease or more probably as the hemodynamic consequences of a definitely "non-draining" saphenous system. Residual varicose veins or a nondraining residual saphenous trunk could induce new-vessel formation with progression, a process that stabilizes with the appearance of a reentry communicating vein (inguinal neovascularization). The poor prognosis of the diffused varicose veins could be explained by the fact that it corresponds to an already nondrained system resulting from a previous stripping. The correlation between a greater number of incisions during redo surgery (which is directly related to the extent of the varicose network) and recurrence of

Table 1. Types and Locations of Recurrent Varicose Veins ($n = 86$ Extremities) at Long-Term Follow-Up after Patch Interposition to Treat Recurrent Saphenofemoral Incompetence with Complete Removal of Varicose Veins and Incompetent Residual Saphenous Trunk

Type (No./% of Extremities) and Location	No. of Recurrent Veins
B1 (54/62.7)	
Varicose veins and varicosities	38
Groin	22
Thigh	57
Lower leg	67
Thigh or lower leg	81
Popliteal fossa	4
B2 (32/35.5)	
Popliteal fossa	2 SSV, 1 RSSV, 4 PPF, 1 RPPF
Thigh	8 TP
Lower leg	10 LP
Groin, thigh, lower leg	2 RVFJ, 1 RVFJ + TP, 1 RVFJ + RSSV
Groin	1 RVFJ

SSV = short saphenous vein; RSSV = recurrent short saphenous vein; PPF = perforator in popliteal fossa; RPPF = recurrent perforator in popliteal fossa; TP = thigh perforator; LP = leg perforators; RVFJ = recurrent varicofemoral junction (new communication between the femoral vein and varices in the groin). Type B1 = presence of visible or palpable varicose veins, exceeding 3 mm in diameter, but no reflux from the deep to the superficial veins; type B2 = presence of varicose veins and of another incompetent connection between the deep and superficial network.

Table 2. Relation between Types of Varicose Vein Recurrence Assessed Preoperatively and Presence and Absence of Varicose Veins at Follow-Up after Redo Surgery and Relation between Recurrence after Redo Surgery and Number of Phlebectomy Incisions Made during Redo Surgery

Follow-up Results	Type of recurrence and percentage of all recurrences				No. of Incisions
	Type 1	Type 2	Type 3	Type 4	
Varicose veins present (type B1 or B2)	29	12.7	2.3	55.8*	40.12 [†]
Varicose veins absent (type A)	27.3	36.4	6.1	30.3	33 [†]

*p = 0.015 for the difference between the percentage of varicose veins recurrences (type B1 or B2) after redo surgery in extremities with type 4 recurrence compared with the other three types of recurrences.

[†]p = 0.02 for the difference between the number of phlebectomy incisions performed during redo surgery on patients with varicose veins at follow-up after redo and the number of phlebectomy incisions performed on those without varicose veins at follow-up.

Type 1 = presence of a saphenous trunk with a direct connection to the femoral vein by means of a residual stump (junction or collateral of the intact sapheno femoral junction); type 2 = presence of a saphenous trunk with an indirect connection to the femoral vein by means of newly formed vessels in the groin; type 3 = presence of an isolated saphenous trunk with the proximal end not connected to the incompetent residual stump; and type 4 = presence of a residual stump associated with diffuse varicose veins. At follow-up, type A = absence of varicose veins; type B1 = presence of visible or palpable varicose veins, exceeding 3 mm in diameter, but no reflux from the deep to the superficial veins; and type B2 = presence of varicose veins and of another incompetent connection between the deep and superficial network.

varicose veins after such surgery suggests (Table 2) that varicose disease is sometimes serious and progressive. The same comment can be made for recurrence after redo surgery and type 4 recurrence.

For patients of our series, the fact that nonrefluxing superficial new vessels were more common between two contiguous areas than between two noncontiguous areas suggests that new-vessel formation is an ongoing progressive process. The appearance of these new vessels in the inguinal region probably corresponds to the development of new drainage routes to the deep venous system. Hydrostatic pressure in these vessels may account for contiguous proximal-to-distal development, resulting in a higher rate of varicose vein occurrence in the thigh and lower leg in patients with varicose veins in the groin. Turton et al.¹¹ has demonstrated the occurrence of new reflux after stripping procedures in previously normal superficial veins in 19.6% of the cases. Dysfunction may be induced by changes in the hemodynamic organization of the superficial venous system.

To summarize, because it is not possible to restore the quality of drainage of the saphenous vein system, extensive resection of varicose veins during redo surgery is probably another reason for the relatively good long-term results obtained. Unfortunately it is likely that leaving a new nondraining saphenous system when removing a residual saphenous trunk may lead to new varices. Thus it is necessary to carry out a comprehensive hemodynamic exploration of a residual trunk to not remove a trunk that normally drains proximally into the deep system or distally through reentry perforators. The carrying out of recurrent surgery is rather tricky because the necessary ablation of residual saphenous trunks, often justified by the symptomatology deriving from it and the complete removal of varicose veins, justified by an aesthetic point of view, may render the superficial

venous drainage all the more difficult. Nevertheless, for recurrent surgery where the saphenous trunks have already been removed, a complete ablation of the varicose vein system may be hemodynamically questionable but seems to be inevitable to lessen the long-term occurrence of new varicose veins. Excessive resection can prove worse than incomplete resection. More studies will be necessary to demonstrate that accurate adaptation of the venous resection to the hemodynamic dysfunction can improve the long-term follow up.

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Commentary

This interesting study appears to demonstrate that at least with this author's technique for "complete" removal of varicose veins in patients who demonstrated recurrent varicose veins after ligation and stripping, new varicose veins develop. It is difficult to understand how new varicose veins can develop soon after "complete" removal of varicose veins. The author speculates that this is due to the lack of an outflow escape point for the

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superficial drainage system. One would assume that the outflow is the deep venous system. Nevertheless, we have found that recurrence rates can be decreased by closing the great saphenous vein with endoluminal radiofrequency or laser. Using this technique all tributary veins at the saphenofemoral junction are left open. These open tributary veins allow for an escape route for the superficial veins.

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