

## Stump evolution after great saphenous vein stripping with high ligation

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### Abstract

The aim of the present observational study is to show the evolution of great saphenous vein (GSV) stump in two different periods of follow up. From 2001 to 2009, 500 legs with GSV insufficiency and terminal valve reflux, operated on with stripping by invagination without crossectomy, were followed. Doppler were performed at 1 month (early) and then mid-term (2-year follow-up). The hemodynamic examination of residual stumps showed 4 different types: S1) draining and competent terminal valve; S2) thrombosis and fibrosis; S3) turbulence under Valsalva maneuver and normal antegrade flow at rest; S4) turbulence with reflux at rest: refluxing terminal valve. *Early*: the most common finding was S1 (64%), then S2 (18%), S3 (12%) and S4 (6%); S1-S3 patterns were considered as *good* evolution (94%), whereas S4 were considered *recurrence*. *Mid-term phase*: the most common finding was again S1 (67%), then S3 (15%), S4 (10%) and S2 (8%). S1 evolution: out of 319 legs in S1 group at early phase, 294 (92%) remained still in S1 at mid-term follow up; 25 (8%) worsen to S3. S2 evolution: out of 92 legs in S2 at early phase, 42 (46%) improved to S1, 40 (43%) did not change pattern across time and 10 legs (11%) worsen to S4. S3 evolution: almost the legs in S3 (51, 86%) remained unchanged at mid-term, whereas 8 (14%) worsen to S4. S4 evolution: all the patients in S4 class at early follow up were still in the same class at mid-term. The evolution of GSV stump can be classified in 4 different patterns, where only S4 should be considered failure.

### Introduction

Incorrect ligation of saphenofemoral junction (SFJ) with a residual stump of great saphenous vein (GSV) left at first vein procedure has been advocated as the main reason

for recurrence. The stump can enlarge with time due to persistent retrograde flow from the common femoral vein; in presence of connection to superficial venous system it causes recurrent varicose veins.<sup>1,2</sup> However, this concept has been confuted by the results of many studies, reporting high rate of recurrence (up to 60%), even in presence of extremely correct SFJ at first surgery.<sup>3,4</sup> Finally, the advent of either endovascular treatment or surgery with high ligation, sparing SFJ junction and leaving GSV stump, with lower rate of late recurrence (from 9.8 to 26%), has definitely demonstrated that the presence of GSV stump in the groin is not necessarily correlated to late recurrence.<sup>5-8</sup>

In the era of SFJ sparing,<sup>5-15</sup> one of the most important issue to deal with is the assessment of evolution of GSV stump. Disselhoff and colleagues<sup>6</sup> evaluated just the abolition of GSV reflux after endovenous laser ablation by its complete obliteration, and duplex ultrasound (DUS) recurrent varicose veins were classified in accordance with an old classification.<sup>16</sup> Pichot and colleagues<sup>7</sup> described the evolution of 60 limbs after radiofrequency operation, stratifying in three groups: complete SFJ complete occlusion, open SFJ with short patent GSV segment (with and without SFJ reflux) and open SFJ with long patent GSV segment (with and without SFJ reflux).

The aim of the present observational study is to show the evolution of GSV stump in two different period of follow up (early to mid-term).

### Materials and Methods

#### Population

From 2001 to 2009, 500 legs in 481 patients (389 females, 92 males) with GSV insufficiency and terminal valve reflux, operated on with invaginating stripping with high ligation,<sup>5</sup> were followed up in order to classify the evolution of residual stump. This was retrospective study of prospectively collected data.

The study was approved by the Institutional Review Board (Local Ethical Committee) and given the retrospective observational nature of the research the informed consent was waived. In 19 cases, a bilateral GSV disease was treated. The average age was  $46 \pm 15$  years.<sup>17</sup> All the patients showed class  $\geq 2$  of the Clinical-Etiology-Anatomy-Pathophysiology (CEAP) classification.

#### Duplex evaluation

The anatomic and hemodynamic features were evaluated by means of DUS (Esaote AV4 and MyLab 50, Esaote Group, Genova, Italy) always performed by the same operator (CP), with the patient in the upright position; the

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diameter of the GSV was measured preoperatively 10 cm below the junction.

### Surgery

Surgery was performed under local anesthesia, femoral block and Klein tumescence (20 mL of 2% lidocaine, 1 mL adrenaline (1:1000), 5 mL of sodium bicarbonate solution (8.4%) and mixed in 500 mL of lactated Ringer's solution). All the operations were performed by a single expert surgeon (PC). The first step was to hook GSV at leg level, via a very small incision and then a stripper was inserted. The invaginating stripping was limited by echo-guided mapping. Finally, GSV was hooked at level of the thigh, 2-3 cm below the groin (SFJ), so, the GSV ligation was performed roughly close to one tributary vein, to leave a physiological drainage. In all cases associated phlebectomy was performed.<sup>5</sup> Anterior accessory saphenous vein was treated simultaneously to GSV only in 2 cases.

### Follow-up

Clinical examination and DUS were performed at 1 month (early) and then every year, considering mid-term as 2-year follow-up. The Valsalva maneuver was also used to assess the terminal valve competence at groin level. All the patients blow through a small straw to standardize the test.

### Definitions

The hemodynamic examination of residual stumps either early or mid-term after GSV surgery without high ligation of the SFJ was subdivided into four different types: S1) draining and competent terminal valve (Figure 1); S2)

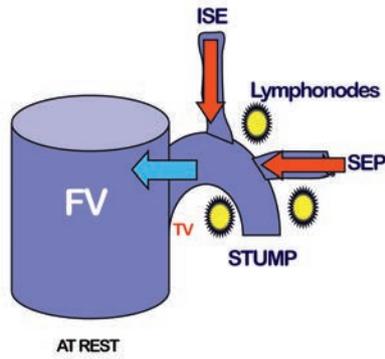


Figure 1. Pattern S1. ISE, inferior superficial epigastric; FV, femoral vein; SEP, superficial external pudenda; TV, terminal valve.

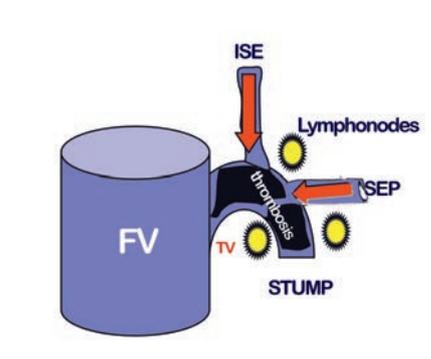
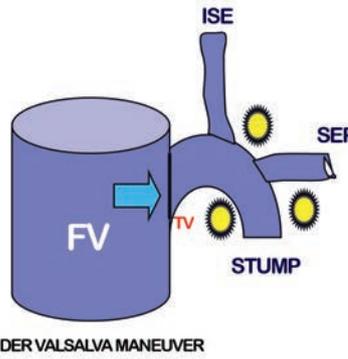


Figure 2. Pattern S2. ISE, inferior superficial epigastric; SEP, superficial external pudenda; FV, femoral vein; TV, terminal valve.

thrombosis and fibrosis: partial or total thrombosis of the stump (Figure 2) that might evolve towards fibrosis; S3) draining at rest and turbulence under Valsalva maneuver (Figure 3); S4) turbulence with reflux at rest: refluxing terminal valve with possible formation of large neovascular vessel (Figure 4).-Good evolution was defined as absence of reflux at the SFJ. Conversely, recurrence identified legs where there was a recurrent reflux at the SFJ.

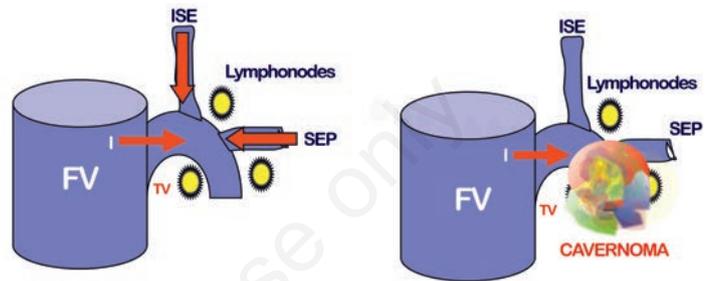


Figure 3. Pattern S3. ISE, inferior superficial epigastric; SEP, superficial external pudenda; FV, femoral vein; TV, terminal valve; I, incompetence; T, turbulence.

**Statistics**

Categorical data was reported as count and percentage. Wilcoxon's test was used to compare early and mid-term stump evolution. Software used was SPSS (SPSS Inc, Chicago, IL, USA).

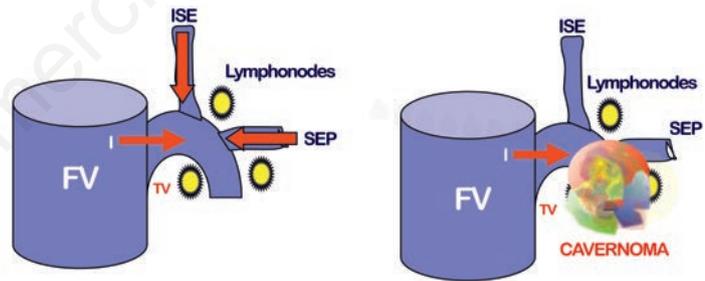


Figure 4. Pattern S4. ISE, inferior superficial epigastric; SEP, superficial external pudenda; I, incompetence; FV, femoral vein; TV, terminal valve; T, turbulence.

**Results**

At preoperative DUS evaluation, all terminal valves were incompetent. The average diameter of GSV was 8.1±1.3 mm.

**Early postoperative phase**

The most common finding was obviously S1 (319.64%), then S2 (92.18%), S3 (59.12%) and S4 (30.6%) (Figure 5); S1 to S3 were considered as *good* evolution (47.9%), whereas S4 was considered *recurrence*.

**Mid-term phase**

At 2-year DUS control, the most common finding was again S1 (336.67%), then S3 (76.15%), S4 (48.10%) and S2 (40.8%) (Figure 5).

**Early-to-midterm evolution**

The evolution of 4 stumps from early to mid-term phase showed that the change over time was statistically significant (P<0.001).

S1 evolution: out of 319 legs in S1 group at early phase, 294 (92%) remained still in S1 at mid-term follow up; 25 (8%) worsened to S3.

S2 evolution: out of 92 legs in S2 at early

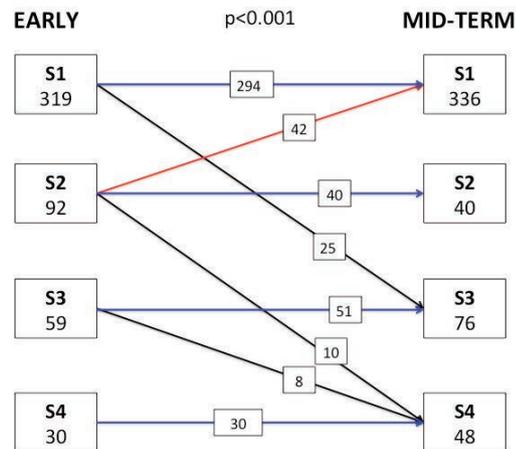


Figure 5. Stump evolution from early to mid-term phase.

phase, 42 (46%) improved to S1, 40 (43%) did not change pattern across time and 10 legs (11%) worsened to S4.

S3 evolution: almost the legs in S3 (51.86%) remained unchanged at mid-term, whereas 8 (14%) worsened to S4.

S4 evolution: all the patients in S4 class at early follow up were still in the same class at mid-term.

## Discussion

This observational study describes the evolution of GSV stump left in site after surgery with high ligation. With the aid of DUS, four different patterns of stumps have been identified. Most of patients (64%) showed good outcome with a stump draining well along with a competent terminal valve. Pichot and colleagues<sup>7</sup> reported a similar pattern ranging from 50% to 92.4%, in their experience, according to the length of the stump. In these cases, terminal valve (TV) is open at rest with drainage from some tributaries such as inferior or superficial epigastric and superficial external pudenda. However, Pichot and colleagues<sup>7</sup> did not describe the behavior of TV under Valsalva maneuver. In our experience, the TV remains competent even in this case with no reflux from common femoral vein to GSV stump; in these cases, surgery was effective to reduce GSV dilatation at the level of TV, providing a new competence to the valve. This pattern remained stable in most of cases, but in 8% of cases it involved towards S2 with turbulence and no reflux. The explanation of this worsening is not so clear, likely due to abnormal flow through little veins and lymphatic along with an involution of TV, which becomes incompetent even at rest.

In 18% of cases (S2), the presence of thrombosis in the stump is *per se* occlusive and hampers the reflux from common femoral vein to GSV stump. Our rate is higher than the one reported by Pichot and colleagues<sup>7</sup> (8.3%), but even in their study no reflux was recorded. In high rate of cases (86%), this pattern remained stable over time and can be considered as good result of surgery, since the stump is continuously washed out by tributaries towards the TV valve. However, in remaining 14% of cases, a bad evolution towards the failing pattern (S4) was recorded over time. Probably a spontaneous recanalization very likely unmasked the TV incompetence, causing turbulence. The third pattern (S3) should be considered as a warning pattern. In fact it could not be defined as failure yet, with an antegrade flow from the tributaries to GSV and then to the common femoral vein; but, under Valsalva maneuver, the TV became refluxing and turbulence was recorded by DUS. In this

pattern, the patient should be strictly followed up. However, in our experience this pattern remained stable by two years of follow up.

Finally, in 6% of cases, lower than 8.3% reported by Pichot and colleagues,<sup>7</sup> surgery fails to restore the competence of TV, very likely due to high grade of dilatation or because of disruption of valve cusps (S4). This pattern is irreversible and might evolve to very large neovascular vessels (2/48). Lefebvre-Vilardebo<sup>17</sup> showed that lymph nodes in the neighborhood of the ligated saphenous stump might actually contribute to the recurrence of disease. The presence of tiny veins (1-4 mm) passing through the surrounding lymph nodes was detected at postoperative DUS examination of the groin, suggesting a role of lymph nodes in the neovascularization process.

## Limitations of the study

This main limitation of this study is that it is only a descriptive observational analysis, without any possibility to identify any patient or vein characteristic associated more with a specific pattern rather than another one. Further investigations to identify anatomic and hemodynamic risk factors for persistent TV incompetence, even after surgery, should be evaluated, since most of vein surgery today is focused to spare the SFJ.

## Conclusions

The evolution of the GSV stumps can be classified in four different patterns, where only S4 (incompetent TV at rest) should be considered failing outcome of surgery and periodically treated with foam under echo-guide. In S3 cases, a strict follow up is mandatory.

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