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Sapheno-femoral Junction Reflux in Patients with a Normal Saphenous Trunk

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Objective. *To determine the patterns and clinical importance of saphenofemoral junction (SFJ) reflux in patients with chronic venous disease (CVD) and a normal great saphenous vein (GSV) trunk.*
Methods. *Fifteen hundred consecutive patients were examined using duplex ultrasound (DU) in three centres. Patients with reflux involving the SFJ and/or its tributaries only were included and its prevalence and patterns were studied. Patients with GSV trunk reflux or in any other veins were excluded. The SFJ diameter was categorised as normal, dilated or varicose. The results of surgery were evaluated by DU in 42 patients 1 year after the procedure.*
Results. *SFJ area incompetence with a competent GSV trunk occurred in 8.8% of limbs. It was significantly more common in CEAP class 2, 13.6% compared to class 3, 8.2% ($p=0.03$), class 1, 2.7%, class 4, 4.4% and classes 5 and 6 together, 1.5% ($p<0.001$ for all). The SFJ had a normal diameter in 21%, dilated in 62% and varicose in 17%. Reflux was seen in 39% of limbs with a normal SFJ diameter, in 85% of those with a dilated SFJ and in all varicose SFJs. Of the 42 operated limbs, 27 had ligation and division of the SFJ and tributary phlebectomies. Fifteen had tributary phlebectomies only, leaving the SFJ intact. At one-year follow-up, SFJ area reflux was found in six limbs (14.3%), involving the SFJ alone in 1, a main tributary in 1 and 4 small tributaries. No reflux was found in the GSV trunk. All but two of the 42 patients were satisfied with the results.*
Conclusions. *SFJ reflux with tributary involvement and sparing of the GSV trunk occurs in 8.8% of CVD patients. Such reflux is found in the entire spectrum of CVD, but it is more common in class 2. Local surgery with or without SFJ ligation has very good results at 1 year. DU scanning prior to treatment is important in all patients so that the intact GSV can be spared.*

Keywords: Chronic venous disease; Saphenofemoral junction reflux; Competent great saphenous vein trunk; Duplex ultrasound.

Introduction

Chronic venous disease (CVD) affects approximately 27% of adults,[1] with a substantial effect on physical health aspects of quality of life.[2] Reflux in the superficial veins, the most prevalent pathology in all CVD classes, is often collectively reported as great saphenous vein (GSV) or small saphenous vein (SSV) incompetence, and the clinical importance of non-truncal patterns of reflux remains unrecognised.[3]

GSV stripping is used frequently as a treatment for symptomatic cases. GSV is the preferred conduit for coronary bypass grafting and other vascular procedures,[4] and a coexistence of CVD and arterial obstructive disease as high as 20% has been reported in patients with leg ulcers.[5] Hence, it is important to differentiate saphenous from non-saphenous pathology before surgical intervention.

This study aimed to determine the pattern and clinical significance of SFJ reflux in patients with CVD with a normal saphenous trunk, and to establish the short-term results of GSV sparing-surgery in these patients.

Methods

Data on 1500 limbs of consecutive patients with evidence of CVD examined in three different centres were prospectively entered in a customised database. A careful interview and physical examination were performed in all patients, and colour-flow duplex imaging was used. Investigators who had at least 5 years experience in the evaluation of lower extremity

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CVD performed ultrasound scanning (NL, CAE, SIA). The leading author visited the other centres to demonstrate the protocol of the study and to ascertain the quality of the investigations. This was done by supervising many ultrasound examinations and the reading of the results.

Patients with reflux involving the SFJ and, or tributaries at the SFJ only were included in the study. Patients with reflux in the GSV trunk or any other vein were excluded from the analysis. The CEAP classification was used to grade the severity of CVD.[6]

The veins examined included the common femoral, femoral, popliteal, deep calf veins, GSV, SSV and their tributaries following previously described examination methods.[4] Superficial non-saphenous and perforator veins were traced as well. The prevalence and patterns of SFJ reflux were studied in all three centres. Reflux was induced by distal limb manual calf compression followed by sudden release, and considered to be present when retrograde flow lasted more than 0.5 s. The diameter of the SFJ was measured in the standing position and categorized as normal size, dilated or varicose. It was considered normal if the vein diameter was ≤ 7 mm, dilated if it was >7 mm and varicose if the macroscopic venous anatomy indicated so. A vein was termed varicose only when it was dilated with clearly visible wall irregularities. The cut-off value was selected from our experience (unpublished data). The type of surgical intervention was influenced by the results of the duplex ultrasound and by surgeon's preference, guided also by the appearance of the vein intraoperatively. More specifically all varicose SFJs were ligated and divided. Those with a diameter less than 7 mm were left intact, while the dilated SFJs were managed at the surgeon's discretion. Phlebectomies were performed in all the incompetent tributaries. The results of surgery were evaluated by duplex ultrasound in 42 patients in one centre (Loyola University Medical Center) one year after the procedure. The remaining 90 patients were treated as well but did not have a subsequent ultrasound examination. The diameter of the competent GSV trunk was measured two transducers (8 cm) length below the SFJ during the first examination and at the one-year follow-up. This site was chosen because was far enough from the site of surgery and easily measured by the length of the ultrasound transducer. Evidence of new reflux sites or residual reflux at the site of previous surgical intervention was sought.

The patients were asked about the results of the operation during the last ultrasound examination. This was subjective and expressed only the patients' opinion without the use of specific questionnaires.

Statistical analysis

Differences in proportions were analysed with Chi squared test. Yates correction for continuity and Fisher's exact test were used accordingly when the sample size in any cell was small. Confidence interval analysis with *t*-distribution ($n<100$) was performed to compare the GSV trunk diameter before and after surgery.

Results

Reflux in the SFJ area with normal saphenous trunk occurred in 132 of 1500 limbs studied (8.8%). A typical example from this group of patients is shown in Fig. 1. SFJ was involved in 103 limbs (6.9%). The signs and symptoms ranged from CVD class 1 to 6; a quarter of them belonged to classes 4 to 6, but the prevalence of SFJ reflux was significantly more common in CVD class 2, 13.6% compared to class 3, 8.2% ($p=0.03$), class 1, 2.7%, class 4, 4.4% and classes 5 and 6 together, 1.5% ($p<0.001$ for all) (Table 1). All patients with skin damage had reflux in varicose tributaries extending at least in their calf. The SFJ had a normal diameter in 21%, was dilated in 62% and varicose in 17% of limbs. Reflux was seen in 39% of limbs with normal SFJ diameter, in 85% of those with dilated SFJ and in all cases with varicose SFJ.

Of the 42 operated limbs, 27 had ligation and division of the SFJ and tributary phlebectomies. Fifteen had tributary phlebectomies only, leaving the SFJ intact. At one-year follow-up reflux in the SFJ area was found in 6 limbs (14.3%). None of the divided SFJs had an occlusion of the GSV main trunk. One patient who had phlebectomies alone developed thrombosis in the upper thigh GSV and subsequently segmental reflux in that area. Reflux in the SFJ was detected in 1, in a main tributary in 1 and in 4 small serpentine tributaries of <2 mm in diameter.

The mean diameter of the GSV trunk (8 cm below the SFJ) was reduced after surgery but this did not reach significance. The diameter decrease was larger when the SFJ was ligated compared to the tributary ligation alone but still not significant (Table 2).

All but two of the 42 patients were satisfied with the results (95.1%).

Discussion

SFJ dysfunction was thought to be the anatomic site where GSV insufficiency starts, proceeding in a retrograde fashion.[7] Our group previously showed that primary venous reflux can occur in any superficial or

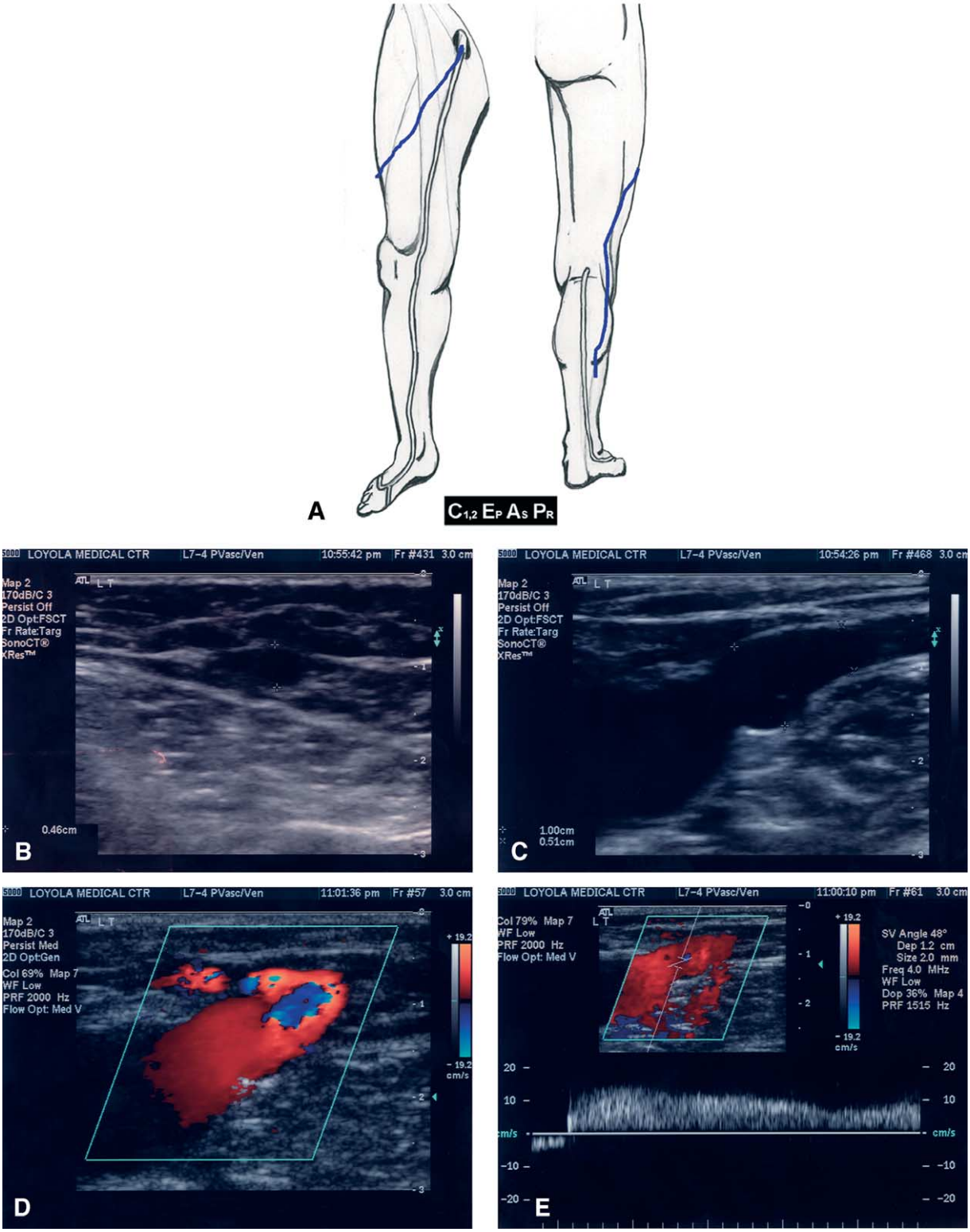

Fig. 1. This drawing and pictures are from a 26 year-old female, with three pregnancies and a positive family history for varicose veins. She was referred to our laboratory with complaints of pain and itching along the varicosities and swelling in her left lower extremity. The duration of her symptoms was about 4 years. Evaluation by duplex scanning demonstrated normal deep and perforating veins. (A) The GSV and SSV were competent. (B) The diameter of GSV at the thigh measured 4.6 mm. (C) The SFJ was dilated measuring 10 mm. (D) It had significant reflux emptying into a tributary and not the GSV. (E) The anterior accessory saphenous vein had marked reflux and was the only tributary involved.

Table 1. Distribution of reflux in the SFJ area according to CEAP clinical class

CEAP class	Limbs	SFJ area reflux *n* (%)	% Out of the 132 limbs
1	186	5 (2.69)	3.79
2	692	94 (13.6)	71.21
3	257	21 (8.17)	15.91
4	228	10 (4.39)	7.58
5,6	137	2 (1.46)	1.52
Total	1500	132 (8.8)	100

deep vein of the lower limbs and in the absence of SFJ or GSV incompetence. It is often found at different sites that may not communicate or affect each other. This suggests that reflux is likely due to a local or multifocal process in addition to, or separate from a retrograde process. Our findings indirectly support the weakening of the vein wall theory.[3,8] The low prevalence of 6.9% for SFJ reflux in our study supports this further.

There is limited information in the literature about the patterns of non-truncal saphenous reflux. We recently reported its pattern and prevalence in a study involving 860 limbs, where we found a 9.7% prevalence among patients with symptomatic CVD.[2] The current study is larger, includes data from other centres and has results from surgery in this population. To the best of our knowledge, there are no published comparable data. Most limbs have signs and symptoms of CVD class 2. Sixty-two percent of the limbs had a dilated SFJ lumen. The 7 mm diameter cut-off in our study was chosen based on our prior experience. Recent studies showed a GSV diameter of 7.3 mm or greater to be accurate in determining haemodynamic impairment and clinical severity in a model with SFJ and GSV incompetence, predicting both reflux and also critical venous incompetence.[9] Escribano *et al.*[10] arrived to similar conclusions when studying 58 patients in an identical model, finding 7.1 mm to have a clear relation with the need for subsequent SFJ interruption.

Stripping of the GSV has shown to be a useful procedure in the management of varicose veins.[11,12] Stripping reduced clinical recurrence by two-thirds after 5 years in a study conducted analysing 133 limbs that underwent GSV stripping vs. SFJ ligation alone.[12] A normal or even an incompetent but undilated GSV may be spared, particularly in high-risk patients for arterial disease.[13] The outcome of patients with an intact GSV trunk and clinical evidence of CVD has not been studied. Surgical methods include GSV-sparing surgery, using avulsion of local varicosities, SFJ or perforator vein ligation, and valve repair at the SFJ.[14] Hammersten *et al.*[15] showed GSV preservation was adequate for use in arterial vascular reconstructions in 78% of cases. The residual GSV after SFJ ligation was also suitable for use as a vascular graft in the majority of patients.[16] The current study demonstrated that all GSV trunks were patent 1 year after surgery. One case developed transient thrombosis. Segmental reflux in the affected area of the GSV trunk was found after the recanalisation of the vein. The GSV trunk diameter 8 cm below the SFJ was numerically reduced after surgery but this did not reach statistical significance. The diameter of the vein at this level was normal to begin with so this result might have been anticipated.

Our study showed a 14.3% prevalence of reflux after surgical intervention, and the large majority of these cases were due to neovascularisation (66.7%). The pattern of reflux was found to be quite variable with multiple sites of incompetence by Jiang *et al.*[17] A 20–80% recurrence rate of varicose veins after surgery has been reported between 5 and 20 years of follow-up.[18] Perrin *et al.*, in the REVAS study (Recurrent Varices After Surgery) identified several factors associated with recurrence, and classify them in two groups: those arising from inadequate or incomplete initial treatment, due to tactical or technical errors, and those arising from evolution or progression of varicose disease.[18] Others have shown the appearance of new sites of reflux secondary to neovascularisation (defined as thin-walled, serpentine tributaries arising from a previously ligated SFJ), even after the appropriate surgical intervention has been carried out.[11] A histological study of varicose veins was conducted, and neovascularisation was found to be the main cause for recurrent SFJ incompetence, being responsible for recurrence in 68% of cases.[19] Those results are

Table 2. GSV trunk diameter 8 cm below SFJ at baseline and one year after surgery

	Total ($n=42$)		SFJ ligation ($n=27$)		Tributary ligation ($n=15$)	
	First exam ($n=42$)	At one year ($n=42$)	First exam ($n=27^{*}$)	At one year ($n=27$)	First exam ($n=15^{\dagger}$)	At one year ($n=15$)
Mean	4.8	4.57	5.1	4.7	4.6	4.4
SD	0.7	0.6	0.8	0.7	0.9	0.8
95% CI	4.58–5.02	4.38–4.76	4.78–5.42	4.42–4.98	4.1–5.1	3.96–4.84

SD, standard deviation; CI, confidence interval. $p>0.05$ for all comparisons. Comparison between those who underwent tributary ligation and the ones who had SFJ ligation as well, showed no significant differences ($p>0.05$).

* SFJ ligation.

† Tributary ligation only.

in agreement with our finding that two thirds of recurrences were attributable to this problem. Our data may have shown a lesser rate of neovascularisation possibly due to the fact that we did not perform extensive surgical procedures at the SFJ, minimising the amount of local damage and, therefore, minimising neovascularisation. In review of our data, we propose avoidance of SFJ ligation in cases where its diameter and wall appearance are normal. When the SFJ is varicose it should probably be ligated. However, as there is no long-term follow-up it is difficult to make any definite recommendations.

Results at 1-year follow-up revealed no reflux in the GSV trunk. This finding may be explained either by the short follow-up or the protective effect of surgical intervention. Therefore, a longer follow-up period might be needed to define the true incidence of GSV trunk reflux in this group of patients.

Over 95% of patients in our study expressed satisfaction with surgical results. This is slightly higher than other studies in which a 75–89% satisfaction rate after surgical intervention has been reported for symptomatic CVD.[11,20] This was probably due to the less severe CVD presentation in the majority of our patients and less complicated operations in our series.

Conclusion

Our study revealed that 9% of patients presenting with CVD show SFJ reflux with tributary involvement without involving the GSV trunk. Such reflux is found in all clinical classes, but more commonly within class 2. Short-term results of local surgical intervention with or without SFJ ligation are encouraging, achieving control of the primary pathology and preserving the main GSV trunk for its potential use in several other applications. Duplex scanning assessment is imperative to differentiate the patterns of junctional reflux so that treatment can be tailored accordingly. Further studies with longer follow-up are necessary to confirm our findings and the best management in these patients.

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