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English version of one original chapter of the SFP book: "Ultrasound and Phlebology"

SOCIÉTÉ FRANÇAISE DE PHLEBOLOGIE

Chapter 3

Ultrasound assessment of acute superficial vein thrombosis

Jean-Luc Gillet

Abstract

In patients presenting a clinical suspicion of Superficial Vein Thrombosis (SVT), an ultrasound examination by venous Duplex Ultrasound (DUS) is essential in order to:

- *confirm the diagnosis of SVT*. Although the clinical features are usually suggestive because of the presence of an indurated, inflammatory and painful venous cord, differential diagnoses are possible;
- *define the actual location and extent of the SVT*; an extension is often underestimated by the clinical examination, particularly at the upper third of the thigh and at the popliteal fossa, whereas an extension at the sapheno-femoral or sapheno-popliteal junction is a criterion of severity;
- *diagnose or rule out a concomitant deep vein thrombosis*, which may not be contiguous with the SVT, including in the contralateral lower limb;
- *define the etio-pathogenic context* by distinguishing SVTs occurring in varicose veins from SVTs occurring in non-varicose veins.

When suspecting SVT, the need for a complete DUS examination has been clearly expressed in the joint recommendations made by the *International Union of Phlebology, the International Union of Angiology and the European Venous Forum.*

Introduction

Initially, superficial vein thrombosis (SVT) of the lower limbs was considered a benign disease or a common complication of varicose veins.

Recent studies have shown the potential severity of SVT and defined its place within the venous thromboembolic (VTE) disease along with deep vein thrombosis (DVT) and pulmonary embolism (PE).

An acute SVT is considered a common disease, but the actual incidence of SVT in the adult population remains unknown.

- ***A French study*** **[1] conducted in an urban community of 265,000 inhabitants showed that the annual diagnosis rate was 0.6%. It was lower than expected and lower than the annual diagnosis rate of DVT.**
- **According to another French study conducted using similar methods [2], the annual incidences of lower limb DVT and PE were 1.2% and 0.6% respectively.**
- **However, an Italian study [3] showed that the prevalence of SVT was higher than the prevalence of DVT and PE.**
- **The prevalence of SVT was higher in women and increased with advancing age regardless of gender.**

In patients presenting a clinical suspicion of SVT, an examination by venous Duplex Ultrasound (DUS) is essential in order to:

- ***confirm the diagnosis of SVT.*** **Although the clinical features are usually suggestive because of the presence of an indurated, inflammatory and painful venous cord, differential diagnoses are possible;**
- ***define the actual location and extent of the SVT*****; an extension is often underestimated by the clinical examination, particularly at the upper third of the thigh and at the popliteal fossa, whereas an extension at the sapheno-femoral or sapheno-popliteal junction is a criterion of severity;**
- ***diagnose or rule out a concomitant deep vein thrombosis*****, which may not be contiguous with the SVT, including in the contralateral lower limb;**
- ***define the etio-pathogenic context*** **by distinguishing SVTs occurring in varicose veins from SVTs occurring in non-varicose veins.**

Positive and differential diagnoses of SVT

A patient with an acute SVT usually presents suggestive evocative clinical features in the form of an indurated, inflammatory and painful cord in a venous pathway.

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However, in some contexts such as hypodermititis **(Fig. 1)** or in obese patients for example, only DUS examination can confirm the diagnosis.

The DUS criteria for SVT diagnosis do not differ from the classic diagnostic criteria for venous thrombosis: incompressible vein, usually increased in volume, visualization of intra-luminal material and no flow using color and pulsed Doppler **(Fig. 2)**.

By using a high-frequency ultrasound probe and with proper adjustments of the ultrasound parameters, the diagnosis usually does not pose any particular difficulties.

However, it is necessary to assess the patient's clinical context to make a correct diagnosis of SVT, particularly after thermal or chemical ablation of the saphenous vein or simply after sclerotherapy of varicose veins.

Fig. 1: Ultrasonographic examination revealed the presence of superficial venous thrombosis, which is difficult to identify clinically in the area of hypodermititis, between the two marker traces.

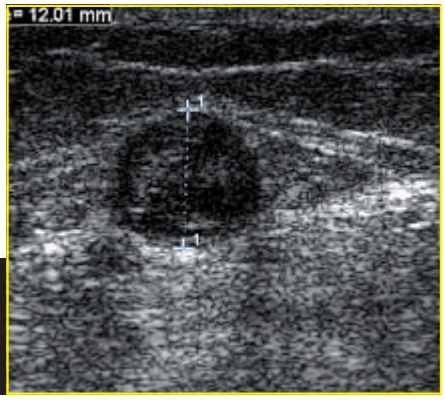

Fig. 2: Ultrasonographic aspect of thrombosis of the small saphenous vein in the calf.

Fig. 3: Ultrasonographic aspect of a thrombosis of the great saphenous vein at mid-thigh.

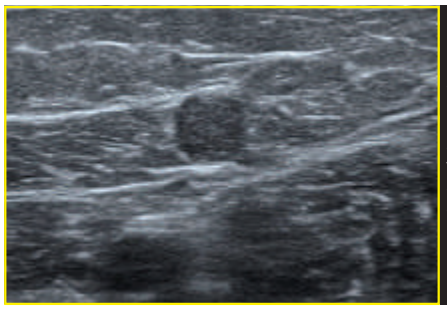

Fig. 4: Ultrasonographic aspect (homogeneous hyper-echoic) of a large saphenous vein, fifteen days after thermal ablation treatment by endovenous laser.
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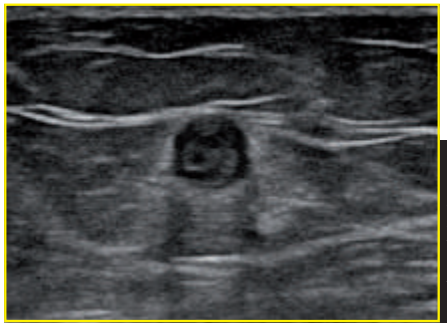

Fig. 5: Ultrasonographic aspect of a large saphenous vein fifteen days after chemical ablation treatment by foam echosclerotherapy.

Indeed, though nuances in the ultrasonographic aspect after thermal ablation have been described [4], including cocardia images, homogeneous hypo-echoic or hyper-echoic images and parietal lesions (they are detailed in a specific chapter of this book), on the basis of DUS criteria alone it is not always easy to distinguish SVT from a vein which has recently been treated by thermal or chemical ablation **(Figs. 3, 4 and 5)**. A precise assessment of the patient's clinical context is necessary to a correct diagnosis.

Vein status: SVT in varicose and non-varicose veins

In epidemiological studies, it is habitual to distinguish SVTs occurring in varicose veins (VVs) from SVTs occurring in non-varicose veins (NVV).

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The SVTs in NVVs represent 10-30% of all SVTs [5, 6, 7, 8].

The clinical consequences of this distinction are beyond the scope of this chapter.

The specific DUS criteria of these two etio-pathogenic entities are not always well specified in studies on SVT.

We consider that the vein hosting the SVT is a non-varicose vein if it is not connected to a varicose network, if it is of a small diameter (less than 4 mm for the great saphenous vein (GVS) trunk at the thigh and less than 3 mm for the small saphenous vein (PVS)), or if a recent DUS examination had identified it as a competent vein [6].

Diagnosis of the actual location and extent of the SVT

Defining the actual location and extent of the SVT requires an accurate DUS examination. This is true in all cases, but especially for saphenous trunks.

Indeed, due to their interfascial localization, clinical signs (inflammation) are often more limited than the actual extent of the thrombosis.

Based on the clinical aspect alone, it is common to overlook an extension of the GVS thrombosis at the sapheno- femoral junction (SFJ) **(Fig. 6)**.

Similarly, the extent of SSV thrombosis in the popliteal fossa can only be assessed by a precise DUS examination.

Fig. 6: Clinical presentation of a patient with thrombosis of the great saphenous vein extended to the sapheno-femoral junction.

The inflammatory signs, limited to the lower half of the thigh, did not allow identification of the extension of the thrombosis to the saphenous termination.

The anatomical pattern of the SSV is highly variable. It is precisely defined by DUS examination. Several anatomical types of the SSV termination have been described.

We recall the classification defined by M. Perrin **(Fig. 7)** [9]. The sapheno-popliteal junction (SPJ) is identified in approximately 75% of limbs [10].

Identifying the extent of the SVT at the SFJ or SPJ is essential. This condition is far from exceptional.

In the POST study [7, 11], a thrombus extension at the SFJ or SPJ was identified in 29% of patients with STV and 21.5% of patients with isolated STV (without concomitant DVT).

The risk of the thrombus extending into the common femoral vein **(Figs. 8 and 9)** or into the popliteal vein has been clearly demonstrated [12].

Patients with extensive SVT at the SFJ or SPJ are usually not included in clinical trials on SVT and are treated with curative doses of anticoagulants as patients with DVT.

As a reminder, PE is associated with DVT on average in 5% of cases [1, 7, 8, 13, 14, 15, 16].

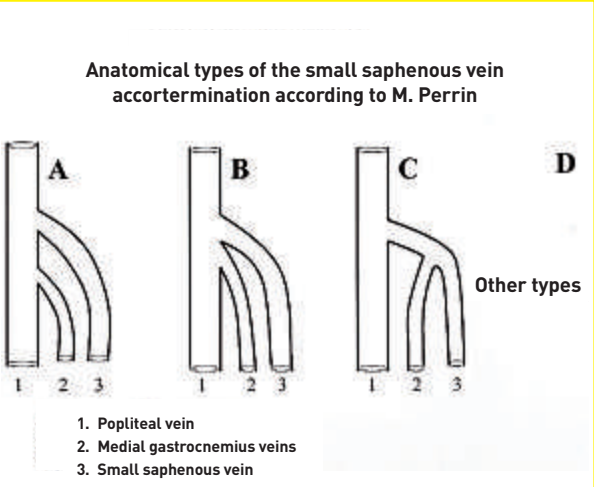

Fig. 7: Anatomical types of the small saphenous vein termination according to M. Perrin:
– **In type A,** the medial gastrocnemius veins (MGVs) and the small saphenous vein (SSV) end up in the popliteal vein (PV) with separate outlets.
- **In type B,** the MGVs and the SSV converge and end up in the PV with a common outlet.
- **In type C,** the MGVs and the SSV merge to form a common channel.
- **In type D,** there is no saphenopopliteal junction. The SSV ends up in the Giacomini vein, in the femoral vein, in the deep femoral vein, in the sciatic vein, etc.

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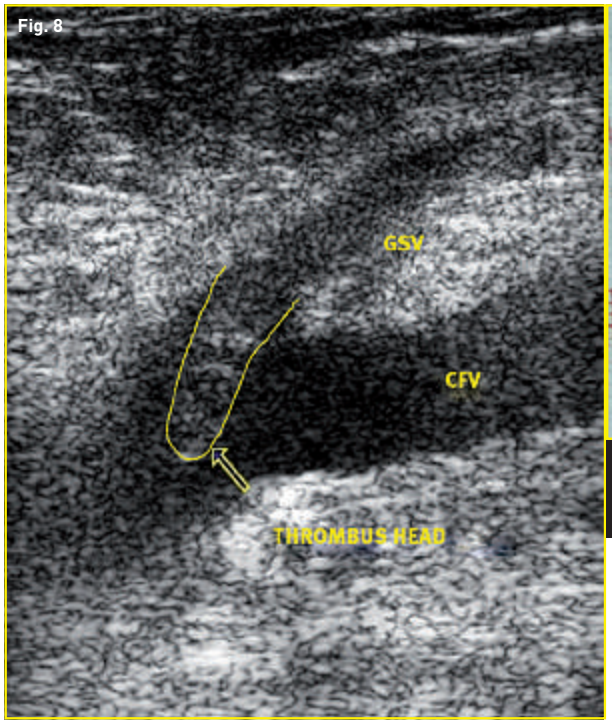

Figs. 8 and 9: Ultrasonographic and surgical aspects of an extension of the thrombosis of the great saphenous vein with a floating clot in the common femoral vein.
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Diagnosis of concomitant deep vein thrombosis

Recognition of the high frequency of DVTs associated with SVTs dates from the years 1990-2000 and was made possible by the development of DUS venous examinations.

The first published series with patients assessed by DUS examination found DVT associated with SVT in 23 to 36% of cases [13, 14, 15, 16, 17].

More recently, two French epidemiological studies [7, 8] confirmed these data in large groups of patients, finding DVT associated with SVT in 25% of cases **(Table 1)**, which is coherent among the different studies.

From data of the literature* [1, 7, 8, 11, 13, 14, 15, 16, 17, 18, 19] *it is possible to define the characteristics of DVT associated with SVT:
- **they are proximal DVT in 40-45% of cases and distal DVT in 55-60% of patients;**
- **they are distant (non-contiguous) from the SVT in 40-45% of cases. They may be contralateral to the SVT and bilateral DVTs are not uncommon;**
- **they occur by expansion of the SVT in almost 60% of cases, from the SFJ or SPJ (40%) or from a perforator (60%), usually at the calf.**

Table 1: Deep vein thrombosis associated with superficial venous thrombosis.

Author	Nb PSTs / Nb SSTs (%)
Lutter *et al.* [13]	53/186 (28.5%)
Barrellier [14]	38/105 (36%)
Jorgensen *et al.* [17]	10/14 (22.7%)
Bilancini *et al.* [15]	25/106 (23.6%)
Gillet *et al.* [16]	32/100 (32%)
Decousus *et al.* [7]	210/844 (24.9%) *(TVP and/or EP)*
Galanaud *et al.* [8]	227/788 (28%)
Frappé *et al.* [1]	42/171 (24.6%)

DVT: deep vein thrombosis
SVT: superficial vein thrombosis
PE: pulmonary embolism.

Epidemiological data clearly show the place of SVT in venous thromboembolic disease and the need for a complete bilateral DUS examination in all patients with lower limbs SVT.

This point was clearly expressed in the joint recommendations made by the *International Union of Phlebology, the International Union of Angiology and the European Venous Forum* [20, 21, 22]:

"All patients with superficial vein thrombosis should have bilateral duplex scanning to exclude deep vein thrombosis (level of evidence: high)".

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Superficial vein thrombosis of the upper limbs

In the literature, only a few studies were published on upper limb (UL) SVT **(Fig. 10)**. There are mainly small series or clinical case reports [23, 24, 25].

The SVTs of the upper limbs differ from SVTs of the lower limbs by the fact that they are usually caused by venous catheterization or venous perfusion and by the rarity of associated DVT.

Fig. 10: Ultrasound appearance of thrombosis of a superficial radial vein in the forearm.

Upper limb SVT can be localized:

- **at the forearm; classically we distinguish (from the outside to the inside): the superficial radial vein, the median antebrachial vein and the superficial ulnar vein;**
- **at the fold of the elbow, in the area of the classic and symmetrical " venous M";**
- **at the arm, in the ce phalic vein or in the basilic vein. The cephalic vein rises to the lateral side of the arm outside the brachialis biceps, traverses the delto-pectoral fascia, then crosses the clavi-pectoral fascia to end up in the axillary vein. The basilic vein, usually of a larger diameter, ascends to the medial part of the arm, travels outside the brachial biceps and perforates the brachial fascia in its middle part to end up into the brachial vein.**

The DUS examination of the UL veins, usually performed because of a painful SVT, should focus on accurately describe the location of the SVT, and also should check the permeability of the deep veins.

Conclusion

Recent studies have shown the potential severity of SVTs and definitely defined their place within the VTE disease along with DVTs and PEs.

While the diagnosis of SVT is usually easily evoked during clinical examination with the presence of an indurated and inflammatory venous cord, only DUS examination can confirm the diagnosis and, in some contexts, make a differential diagnosis.

Epidemiological studies are consistent in showing that DVT is associated with SVT in approximately 25% of cases.

The DVT may be contiguous with, or distant from, the SVT and may be contralateral to the STV.

International recommendations strongly recommend performing DUS examination in all patients with SVT.

Besides confirming the SVT diagnosis and seeking a potential associated DVT, DUS examination focuses on the extension of the SVT, more specifically at the SFJ or SPJ. This extension is often underestimated on the clinical aspect.

In addition, DUS helps to define *the etio-pathogenic context* by distinguishing SVTs occurring in varicose veins from SVTs occurring in non-varicose veins.

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