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ORIGINAL ARTICLE

Management and outcomes of superficial vein thrombosis: a single-center retrospective study

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Abstract

Background: Guidelines suggest but cannot recommend the optimal management of superficial vein thrombosis (SVT).

Objectives: To identify the prevalence of asymptomatic deep vein thrombosis (DVT) at the time of SVT diagnosis, and to report the treatment and 3-month complications of patients with only SVT more than 3 cm from deep vein junction (or unknown distance).

Methods: We performed a single-center retrospective review of patients referred to the Ottawa Hospital thrombosis unit with ultrasound (US)-diagnosed SVT, and followed patients with only SVT for 3 months.

Results: Three hundred sixteen patients with SVT were included. Of the 218 patients without DVT symptoms at presentation, 19 (8.7%; 95% CI, 5.7%-13.2%) were found to have asymptomatic concomitant DVT (11 proximal and 8 distal), and 45 (20.6%) had SVT within 3 cm of the saphenofemoral or saphenopopliteal junctions. Among the 192 patients diagnosed with SVT only, we observed 3-month thrombotic complications in 56 (29.2%; 95% CI, 23.2%-36.0%) patients, with a total of 69 events: 11 (5.7%) DVTs, 2 (1.0%) pulmonary embolisms, 37 (19.2%) SVT extensions, and 19 (9.8%) SVT recurrences. Eighty-two percent (9/11) of the 3-month DVT and pulmonary embolism events occurred in patients who initially received conservative management. Therapeutic treatment doses were most effective.

Conclusion: At the time of SVT diagnosis, many patients had asymptomatic DVT and SVT near the deep venous system, supporting the systematic use of initial US in patients clinically diagnosed with SVT. The observed differences in 3-month complication rates, according to the treatment provided, highlight the need for large-scale randomized controlled trials to establish optimal management.

KEYWORDS
anticoagulant, deep vein thrombosis, pulmonary embolism, ultrasound, venous thromboembolism

Essentials

- Superficial vein thromboses are associated with a risk of serious thrombotic complications.
- We report a high proportion of asymptomatic concomitant deep vein thromboses with superficial vein thrombosis.
- More than 50% of patients with concomitant symptoms suggestive of deep vein thrombosis had that diagnosis confirmed.
- Outcome disparities between management strategies support the need for further treatment guidance.

1 | INTRODUCTION

Lower limb superficial vein thrombosis (SVT) is a common and painful disease with an estimated incidence of 0.64 to 1.31 per 1000 person-years [1,2]. Historically, SVT was considered a benign, self-limiting disease, diagnosed based on clinical grounds and treated symptomatically with topical or systemic nonsteroidal anti-inflammatory drugs and compression stockings [3]. This perception is now changing as a consequence of epidemiological studies demonstrating a significant risk of venous thromboembolism (VTE) complications associated with SVT, both at the time of diagnosis and subsequently [1,4–6].

Although the potential for severe complications of SVT is gaining more recognition, studies have reported variable rates of concomitant VTE, such as deep vein thrombosis (DVT) and pulmonary embolism (PE), in patients diagnosed with SVT. In a systematic review of 37 studies, at the time of diagnosis, coexistence with DVT was shown in 6% to 53% of patients and PE was shown in 0% to 33.3% of patients [7]. Patient heterogeneity could explain these wide ranges, suggesting a possible lack of consideration for the clinical presentation of the patients at the time of diagnosis since it was generally not documented whether patients had signs or symptoms of DVT. Moreover, the use of ultrasound (US) to confirm the SVT diagnosis has not yet been standardized in clinical practice, although it is suggested by various guidelines [8–12]. This prompts the question of whether the published rates of concomitant VTE hold in patients whose presentation suggests only an SVT, that is, DVT is not suspected at the time of diagnosis, and therefore whether an initial US to rule out DVT is required in all patients with clinically evident SVT.

Given the paucity of high-quality evidence to support the optimal management of patients with SVT, although some guidelines now suggest anticoagulation at prophylactic doses [12], clinically, the treatment continues to range widely from conservative management with watchful surveillance to full-dose anticoagulation [8,13–15]. Moreover, although it has previously been suggested to monitor patients who are not receiving anticoagulation by repeat (serial) US to detect thrombus extension or interim development of DVT [7], very few studies have been conducted to support the utility and cost effectiveness of serial US [16].

To address some of the gaps in our current understanding of SVT complications and management, we performed a single-center retrospective chart review to assess the prevalence of concomitant asymptomatic DVT identified by US in patients presenting with symptoms suggesting an isolated SVT, to assess the current use and usefulness of serial US in patients diagnosed with SVT confirmed by US, and to determine the rate of VTE complications during follow-up of patients with SVT.

2 | METHODS

2.1 | Study design

We performed a retrospective cohort study of outpatients referred to the Ottawa Hospital (TOH) thrombosis unit with an SVT diagnosed by US. In our institution, patients referred for US with suspected SVT are routinely investigated for both DVT and SVT. TOH database warehouse was searched to identify all patients who had undergone an US during a predetermined 4-year period (January 2014 and December 2018). The US reports of the cohort were then screened for patients diagnosed with SVT/thrombus, thrombophlebitis, superficial thrombosis/thrombus, greater/great saphenous vein thrombosis/thrombus, or lesser/small saphenous vein thrombosis/thrombus by US, and these patients were included in the study. This study used data from TOH data repositories. TOH data repositories contain administrative and clinical data on all patients seen at TOH, including financial and human resource data on the organization. Ethics approval was received from the Ottawa Health Science Network Research Ethics Board prior to study initiation.

The first aim of this study was to determine the prevalence of asymptomatic concomitant DVT (in patients with no significant clinical suspicion of DVT) in patients diagnosed with SVT. To identify patients who presented to the thrombosis clinic with symptoms only consistent with the diagnosis of SVT, we extracted information on the patient's clinical presentation from notes written by the referring physician, emergency room physicians, and thrombosis specialists using a predefined list of signs and symptoms for SVT and DVT. Recorded signs and symptoms of lower limb SVT included localized erythema, pain/tenderness and induration along the course of a superficial vein, and the presence of a palpable nodular cord. DVT signs and symptoms recorded included edema or swelling of the entire leg or only the calf, dilated superficial veins (excluding the presenting vein with suspected SVT), and calf pain. Nonlocalized erythema, elevated local temperature, and nonspecific leg pain were also considered symptoms consistent with both SVT and DVT to account for the overlap in the clinical presentation of the 2 diseases as well as nondescriptive clinical notes. Patients were considered to have a clinical presentation consistent with the diagnosis of only an SVT if they had at least 1 SVT symptom and no DVT or nonspecific symptoms.

To address the second aim of this study, we followed patients diagnosed with SVT located more than 3 cm from the saphenofemoral junction (SFJ)/saphenopopliteal junction (SPJ) or at an unknown distance from the junction and no DVT on US at presentation over 3

months. We sought to determine the management patterns of these patients, including the proportion of patients who underwent a scheduled serial US within 14 days of the initial US, as well as to assess the risk of thrombotic complications arising from the SVT. Thrombosis, emergency, and radiology notes were monitored over the 3 months for the thrombotic events described below.

2.2 | Patients

Patients older than 18 years with symptomatic SVT were included in the study if they were seen at the thrombosis outpatient clinics at TOH and underwent an US at the time of diagnosis or the next day, which objectively confirmed the diagnosis of SVT. The SVT diagnosis was confirmed by chart review, and the date of the first ultrasonographic study showing evidence of SVT was considered the index date. Patients were excluded if the US findings were consistent with a chronic SVT, if the SVT was found incidentally, if their charts lacked specific key reports required for our study, and/or if they had already been on anticoagulant therapy for another reason prior to the diagnosis of SVT.

Data on various risk factors were also obtained from patient charts. Chronic risk factors for VTE were varicose veins, active cancer (recently diagnosed or receiving treatment), postthrombotic syndrome, hormone replacement therapy, known thrombophilia, and oral contraceptive pill. Transient risk factors for VTE collected were major surgery, recent trauma, recent hospitalization, travel within the previous 30 days, and recent acute infection.

2.3 | Outcome measures

The primary outcome was confirmed asymptomatic DVT detected by US on day 1. Secondary outcomes were symptomatic and asymptomatic thrombotic events up to day 90 in patients with an initial diagnosis of SVT more than 3 cm from the SFJ/SPJ (or distance unknown) and no DVT. Events recorded on day 1 were symptomatic SVT and symptomatic or asymptomatic DVT of lower limbs. Events recorded on days 2 to 14 (identified by serial US) were SVT extension, SVT recurrence (same or different vein), SVT/DVT resolution, and new DVT of the lower limbs. Events recorded over the 90-day monitoring were SVT extension and recurrence, DVT, symptomatic PE, any symptomatic arterial thromboembolism event, major bleeding event, and death from any cause.

The diagnosis of SVT and DVT was defined as incompressibility, by compression ultrasonography, of a venous segment located along the course of a known superficial or deep vein, respectively. No length ranges for the SVT were used. Imaging varicosities were guided by symptoms and imaged at the operator's discretion. Proximal DVT was defined as a thrombus in the popliteal or more proximal deep veins, whereas distal DVT was defined as a thrombus located caudal to the popliteal vein. Extension of SVT was defined as a substantial increase in the length of the initial SVT on US (no quantitative cutoff was used as exact measurements were rarely included in the US reports). Recurrence of SVT was defined as a new noncompressible segment of a superficial vein either in a different vein from the initial event or in the same vein but distinct from the initial event with an open venous segment between the 2 thromboses. PE was confirmed by a ventilation-perfusion scan or computed tomographic pulmonary angiography. Major bleeding events were defined according to the ISTH definition [17]. Patients were considered to present with asymptomatic thrombotic complications if they had no worsening of their clinical presentation and no new symptoms on the day of the serial US. All therapeutic management of patients was also recorded at the initial visit and at the time of all serial US up to day 90.

2.4 | Statistical analysis

Qualitative data were reported as numbers and percentages, while quantitative data were reported as median values with IQRs. In addition, we computed 95% CI for estimated proportions using the Wilson score method without continuity correction.

3 | RESULTS

3.1 | Total population

Four hundred nineteen patients were seen at the thrombosis outpatient clinic and objectively diagnosed with SVT by US during a predetermined 4-year period (FigureA). We excluded 50 patients whose SVT was found incidentally (ie, patients with no SVT symptoms at presentation but who underwent an US for another reason), 33 patients already on an anticoagulation regimen prior to diagnosis, 18 patients with missing reports, and 2 patients with chronic SVT. Of the 316 remaining patients included in the study, 192 (60.8%) had an SVT more than 3 cm from the SFJ/SPJ (or at an unknown distance), whereas 124 (39.2%) had an SVT within 3 cm of the SFJ/SPJ or an SVT with a concomitant DVT at the time of inclusion (FigureB). The demographics and clinical presentations of patients included in this retrospective review are shown in Table 1. The median age was 57 years (IQR, 47-70 years), and 170 (53.8%) were females.

3.2 | Aim 1: patients with clinical presentation suggesting SVT only at inclusion

A total of 218 patients (69.0%) had a clinical presentation solely consistent with the diagnosis of SVT at the time of the initial US. Of these patients, 199 (91.3%) had an US demonstrating SVT only, whereas 19 (8.7%; 95% CI, 5.7%-13.2%) had a concomitant DVT at the time of inclusion (Table 2). Of the 19 asymptomatic DVTs, 11 (5.0%) were proximal, with 3 (1.4%) contiguous with the short saphenous vein and 8 (3.7%) contiguous with the greater saphenous vein. The remainder 8 (3.7%) DVTs were distal (3 [1.4%] involving deep veins

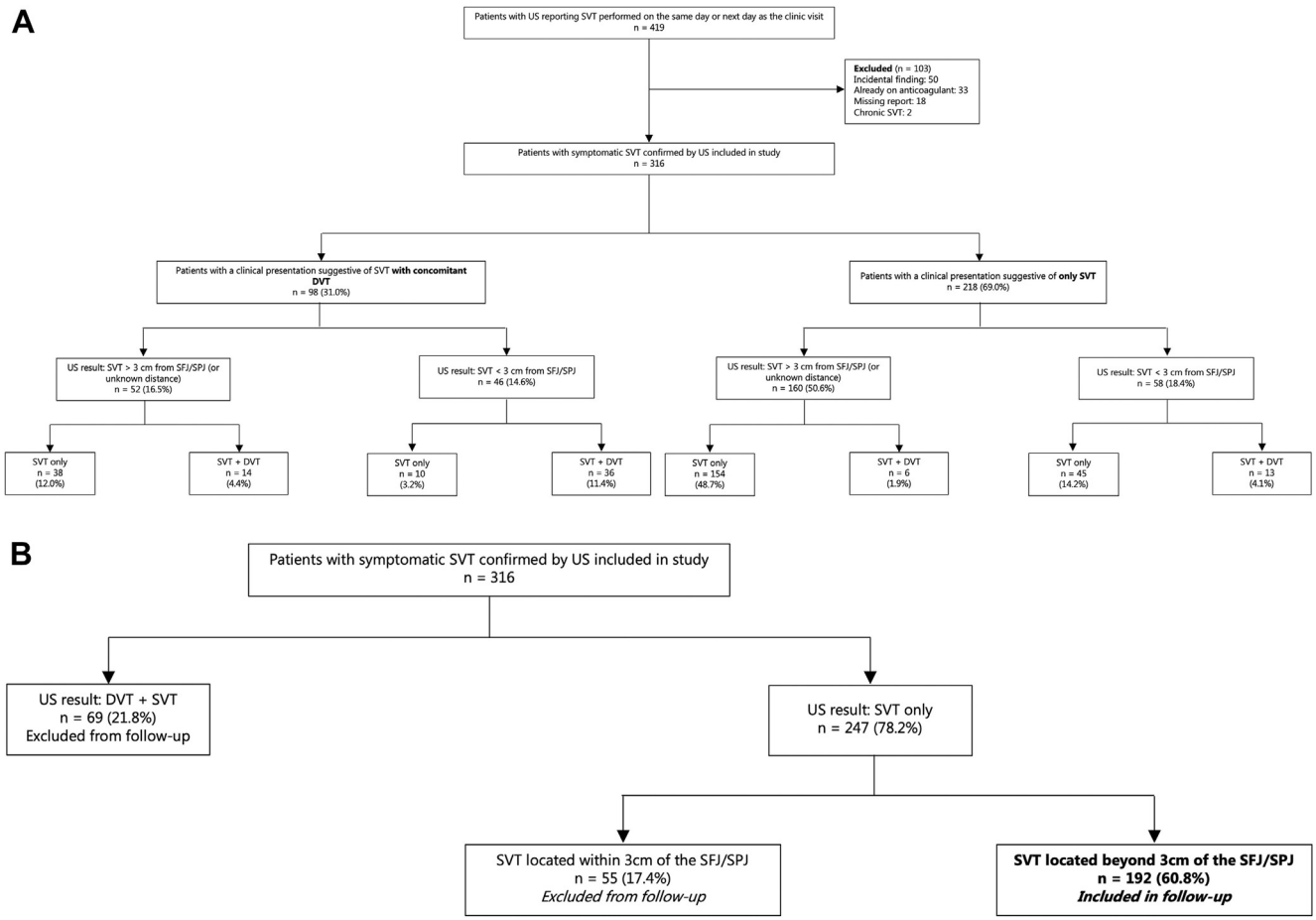

FIGURE Study flow diagram. (A) Aim 1: measuring the prevalence of deep vein thrombosis (DVT) in patients with superficial vein thrombosis (SVT) according to the presence and absence of DVT signs and symptoms. (B) Aim 2: investigating the management and outcome of patients with SVT located beyond 3 cm of the saphenofemoral junction (SFJ) or saphenopopliteal junction (SPJ). US, ultrasound.

and 5 [2.3%] involving muscular veins), and only 1 (0.5%) was contiguous with the SVT. Ten of the 19 patients (52.6%) had at least 1 major VTE risk factor; 5 had a history of VTE, 2 had recently undergone major surgery, 3 had active cancer, and 1 was pregnant. The presence of varicose veins was significantly higher in patients with SVT only compared to patients with a concomitant DVT (57.3% vs 31.6%; P = .03). Of the remaining 199 patients in the subgroup with SVT only on US, 45 (22.6%) had SVT within 3 cm of the SFJ/SPJ. Conversely, among the 98 patients with a clinical presentation suggestive of DVT or nonspecific symptoms, 50 (51.0%) patients were found to have a concomitant DVT by US at the time of SVT diagnosis.

3.3 | Aim 2: management and complications of patients with SVT only at inclusion

Of the 316 total patients included in this study, 192 patients (60.8%) had an SVT more than 3 cm (or unknown distance) from the SFJ/SPJ at presentation (with no DVT). We excluded the SVTs measured within 3 cm of the SFJ/SPJ, as it is common practice to treat these as DVT [8,10,18]. Fifty-nine (30.7%) of 192 patients were started on anticoagulation treatment, ranging from prophylactic to full-dose direct oral anticoagulants; low-molecular-weight heparin; or fondaparinux, while 125 (65.1%) received conservative management, 4 (2.1%) received a combination of the 2, and 4 (2.1%) patients were excluded from analysis due to unknown treatment. Conservative management included oral and/or topical nonsteroidal anti-inflammatory drugs, acetaminophen, or no treatment. Moreover, 112 (58.3%) patients underwent at least one planned serial US, the first being scheduled within 14 days of the initial US, whereas 80 (41.7%) did not undergo a serial US within 14 days.

Comparing the treatment received by patients, depending on whether they underwent a serial US, of the patients who underwent at least 1 serial US, 19 (17.4%) received anticoagulation, and 90 (82.6%) received conservative treatment. On the other hand, of the patients who did not undergo serial US, 44 (55.7%) received anticoagulation, and 35 (44.3%) received conservative treatment. Four patients were omitted from this analysis due to unknown treatment. Patients with cancer were more likely to be offered anticoagulation, whereas those with varicose veins were less likely to be started on

TABLE 1 Patient characteristics at inclusion.

Patient characteristics	SVT >3 cm from SFJ/SPJ (*n* = 192)	SVT + DVT or SVT within 3 cm of SFJ/SPJ (*n* = 124)	Total (*N* = 316)
Age (y), median (IQR)	55 (44-69)	62 (49-71)	57 (47-70)
Women, *n* (%)	111 (57.8)	59 (47.6)	170 (53.8)
History of VTE, *n* (%)			
SVT	39 (20.3)	21 (16.9)	60 (19.0)
DVT	21 (10.9)	32 (25.8)	53 (16.8)
PE	7 (3.6)	6 (4.8)	13 (4.1)
Risk factors, *n* (%)			
Varicose veins	111 (57.8)	41 (33.1)	152 (48.1)
Active cancer	20 (10.4)	22 (17.7)	42 (13.3)
Major surgery (in the past 30 d)	12 (6.3)	6 (4.8)	18 (5.7)
Recent trauma (in the past 30 d)	8 (4.2)	7 (5.6)	15 (4.7)
Recent hospital admission (in the past 30 d)	13 (6.8)	3 (2.4)	16 (5.1)
Recent travel (flight >8 h in duration in the last 30 d)	15 (7.8)	13 (10.5)	28 (8.9)
Postthrombotic syndrome	3 (1.6)	5 (4.0)	8 (2.5)
Hormone replacement therapy	3 (1.6)	0 (0.0)	3 (0.9)
Known thrombophilia	10 (5.2)	3 (2.4)	13 (4.1)
Sclerotherapy (in the past 30 d)	4 (2.1)	5 (4.0)	9 (2.8)
Oral contraceptive pill	8 (4.2)	7 (5.6)	15 (4.7)
Characteristics of VTE events			
SVT, *n* (%)			
Greater saphenous vein[a]	125 (65.1)	98 (79.0)	223 (70.6)
Small saphenous vein	32 (16.7)	33 (26.6)	65 (20.6)
Other superficial veins	52 (27.1)	10 (8.1)	62 (19.6)
At least 2 superficial veins	17 (8.9)	16 (12.9)	33 (10.4)
SVT in varicose veins	78 (40.6)	24 (19.4)	102 (32.3)
Bilateral SVT	4 (2.1)	5 (4.0)	9 (2.8)
DVT, *n* (%)			
Proximal	-	54 (43.5)	54 (17.1)
Distal	-	15 (12.1)	15 (4.7)
Contiguous with SVT	-	46 (37.1)	46 (14.6)
Clinical symptoms at presentation, *n* (%)			
Induration/palpable, nodular cord	130 (67.7)	60 (48.4)	190 (60.1)
Localized pain along the course of the superficial vein	166 (86.5)	77 (62.1)	243 (76.9)
Localized erythema along the course of the superficial vein	128 (66.7)	56 (45.2)	184 (58.2)
Edema of the whole leg/calf	33 (17.2)	58 (46.8)	91 (28.8)
Dull pain	0 (0.0)	21 (16.9)	21 (6.6)
Dilated superficial veins	0 (0.0)	3 (2.4)	3 (0.9)
Elevated local temperature	29 (15.1)	20 (16.1)	49 (15.5)

DVT, deep vein thrombosis; PE, pulmonary embolism; SFJ/SPJ, saphenofemoral junction/saphenopopliteal junction; SVT, superficial vein thrombosis; VTE, venous thromboembolism.

[a]Events were not mutually exclusive—33 patients had at least 2 concomitant superficial vein thromboses in separate locations.

TABLE 2 Results of the initial ultrasound based on clinical presentation.

	Clinical presentation		
US result	**Suggestive of only SVT (*n* = 218)**	**Suggestive of SVT with concomitant DVT (*n* = 98)[a]**	**Total (*N* = 316)**
SVT only,[b] *n* (%)	199 (91.3)	48 (49.0)	247 (78.2)
SVT and DVT, *n* (%)	19 (8.7)	50 (51.0)	69 (21.8)
Proximal DVT	11 (5.0)	42 (42.9)	53 (16.8)
Distal DVT	8 (3.7)	8 (8.2)	16 (5.1)
Contiguous	12 (5.5)	34 (34.7)	46 (14.6)

DVT, deep vein thrombosis; SVT, superficial vein thrombosis; US, ultrasound.
[a]Includes nonspecific presentations and presentations suggestive of presence of deep vein thrombosis.
[b]Includes superficial vein thrombosis within 3 cm of the saphenofemoral junction/saphenopopliteal junction.

anticoagulation. No difference was observed based on small saphenous vein involvement (results not shown).

3.4 | Yield of the serial US in patients with SVT only at inclusion

Although the reasons guiding how the patients were selected to undergo a serial US were not always documented, of the 112 patients who underwent at least 1 planned serial US, 97 (88.2%) had no change in symptoms compared to their initial presentation or had significant improvements in their symptoms at the time of their scheduled follow-up, 13 (11.8%) had worsening clinical presentation or a new symptom, and the symptomatic progression was unknown in 2 patients (omitted from analysis) (Table 3). The first serial US detected 36 thrombotic complications, with 12 (33.3%) being symptomatic and 24 (66.7%) being asymptomatic. Of the asymptomatic events, there were 17 (17.5%) SVT extensions, 3 (3.1%) SVT recurrences, 1 (1.0%) proximal DVT, and 3 (3.1%) distal DVTs (Table 3). Therefore, 4 (4.1%; 95% CI, 1.6%-10.1%) patients who were asymptomatic at the time of the serial US were found to have a DVT. Following the first serial US, the treating physician changed the treatment regimen of 41 (37.3%) patients, whereas 71 (64.5%) remained on the same treatment.

3.5 | Three-month outcomes of patients with SVT only at inclusion

All 192 patients with SVT, more than 3 cm from the deep vein junction (or unknown distance) at inclusion, were followed for up to 90 days for thrombotic complications. Fifty-six (29.8%; 95% CI, 23.2%-36.0%) patients had at least 1 thrombotic complication for a total of 69 events (Table 4). Four patients were excluded from this analysis due to unknown treatment. Among the remaining 188 patients, there were 37 (19.7%) SVT extensions, 19 (10.1%) SVT recurrences (in the same or different vein), 11 (5.9%) DVTs (5 proximal and 6 distal), and 2 (1.1%) PEs. Of the distal DVTs, 2 (1.1%) involved deep veins and 4 (2.1%) involved muscular veins. One patient (0.5%) suffered from an arterial

TABLE 3 Incidence of venous thromboembolism events detected by serial ultrasound (within 14 days of initial presentation) in patients with superficial vein thrombosis more than 3 cm from the saphenofemoral/saphenopopliteal junction (or unknown distance) and no deep vein thrombosis at inclusion.

	Patients undergoing scheduled serial US within 14 d of initial US		
VTE complications[a]	**Symptomatic[b] *n* = 13 (11.8%)**	**Asymptomatic[c] *n* = 97 (88.2%)**	**Total *N* = 110[d]**
Any, *n* (%)	12 (92.3)	24 (24.7)	36 (32.7)
SVT extension, *n* (%)	8 (61.5)	17 (17.5)	25 (22.7)
SVT recurrence, *n* (%)	2 (15.4)	3 (3.1)	5 (4.5)
DVT, *n* (%)	2 (15.4)	4 (4.1)	6 (5.5)
Proximal	1 (7.7)	1 (1.0)	2 (1.8)
Distal	1 (7.7)	3 (3.1)	4 (3.6)

DVT, deep vein thrombosis; SVT, superficial vein thrombosis; US, ultrasound; VTE, venous thromboembolism.
[a]Venous thromboembolism complication events were not mutually exclusive.
[b]Determined by a medical note written by a thrombosis specialist on the day of the serial ultrasound. The patient was considered symptomatic if they experienced worsening of symptoms or new symptoms at the time of the serial ultrasound.
[c]Caught by serial ultrasound. Serial ultrasound had to be planned and performed within 14 days of the initial ultrasound.
[d]Two patients excluded due to unknown presentations at the time of serial ultrasound were unknown.

TABLE 4 Three-month outcome in patients with superficial vein thrombosis more than 3 cm from the saphenofemoral/saphenopopliteal junction (or unknown distance) and no deep vein thrombosis at inclusion based on treatment received.

		Anticoagulation				
3-month outcome	Conservative[a] (*n* = 125)	Total anticoagulant (*n* = 63)	Low-dose DOAC/ LMWH[b] (*n* = 30)	Intermediate-dose DOAC/LMWH (*n* = 14)	High-dose DOAC/ LMWH (*n* = 19)	Total (*N* = 188)[c]
VTE complications,[d] *n* (%)						
Any	58 (46.4)	11 (17.5)	8 (26.7)	2 (14.3)	1 (5.3)	69 (36.7)
SVT extension	33 (26.4)	4 (6.3)	2 (6.7)	1 (7.1)	1 (5.3)	37 (19.7)
SVT recurrence	15 (12.0)	4 (6.3)	3 (10.0)	1 (7.1)	0 (0.0)	19 (10.1)
DVT	9 (7.2)	2 (3.2)	2 (6.7)	0 (0.0)	0 (0.0)	11 (5.9)
Proximal	5 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (2.7)
Distal	4 (3.2)	2 (3.2)	2 (6.7)	0 (0.0)	0 (0.0)	6 (3.2)
PE	1 (0.8)	1 (1.6)	1 (3.3)	0 (0.0)	0 (0.0)	2 (1.1)
Arterial thromboembolism event, *n* (%)	1 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
Major bleeding, *n* (%)	0 (0.0)	1 (1.6)	0 (0.0)	0 (0.0)	1 (5.3)	1 (0.5)
Death, *n* (%)	1 (0.8)	2 (3.2)	0 (0.0)	0 (0.0)	2 (10.5)	3 (1.6)

DOAC, direct oral anticoagulant; DVT, deep vein thrombosis; LMWH, low-molecular-weight heparin; PE, pulmonary embolism; SVT, superficial vein thrombosis; VTE, venous thromboembolism.

[a]Includes oral and topical nonsteroidal anti-inflammatory drugs, acetaminophen, and no treatment.

[b]Includes fondaparinux.

[c]Four patients were excluded from the analysis due to unknown treatment.

[d]Venous thromboembolism complication events were not mutually exclusive.

thromboembolism event, 1 (0.5%) patient suffered from a major bleeding event (on high-dose anticoagulation), and 3 (1.6%) patients passed away over the course of the 90 days after SVT diagnosis. Causes of death were hypovolemic shock due to a major gastrointestinal bleed (on full-dose anticoagulant), and 2 were related to metastatic cancer. Complications occurred in 46.4% of patients managed conservatively and in 5% of those on full-dose anticoagulation, including 8% with DVT/PE vs 0%, respectively (Table 5). Twenty patients with active cancer were included in the 3-month follow-up. Of these, 12 (60%) received anticoagulation as their initial therapy, and only 1 (5.0%), who was initially treated with conservative management, suffered a VTE during follow-up.

4 | DISCUSSION

This single-center retrospective chart review identified 316 patients diagnosed with SVT by US at TOH. We found that asymptomatic DVT accompanying symptomatic SVT at presentation was present in 8.7% (95% CI, 5.7%-13.2%) of patients. More than 50% of patients with symptoms also suggestive of DVT had that diagnosis confirmed. Then, we followed 192 patients diagnosed with SVT more than 3 cm (or unknown distance) from the SFJ/SPJ to assess for management patterns and thrombotic complications. A planned serial US, performed within 14 days of diagnosis in more than half of patients, detected 24 asymptomatic events, with 4 (4.1%) of these being DVTs. Moreover, almost 30% of patients diagnosed with SVT only at inclusion developed at least 1 VTE complication over the 3-month follow-up despite approximately a third of all patients having received some form of anticoagulation. However, 82% of VTE events occurred in patients initially managed without anticoagulation. Interestingly, although the numbers of patients were small, high-dose anticoagulation therapy resulted in only 5% with complications, none of which were DVT or PE, compared to 23% receiving prophylactic or intermediate doses of anticoagulation.

Our approach to identifying the true prevalence of asymptomatic DVT in patients being investigated for SVT by considering patients' clinical presentation yielded results further supporting the standardized use of US at the time of SVT diagnosis. Nearly a third (29.4%) of patients presenting with only symptoms of SVT were found to either have an asymptomatic concomitant DVT or SVT within 3 cm of the deep vein junction and more than half of the DVTs detected were proximal (11/19, 57.9%). In contrast, a concomitant DVT was found in approximately half of the patients with concomitant symptoms of DVT or nonspecific symptoms at presentation. Our reported VTE rates are within the range of previously published observational studies on isolated SVT patients [1,4–6]. Therefore, an initial US at the time of SVT is warranted to measure the distance from the deep vein junction and to rule out the presence of a concomitant DVT since treatment decisions based on the patient's clinical presentation alone may lead to undetected and untreated DVT and serious, potentially life-threatening complications. Moreover, our data also revealed that the presence of varicose veins was significantly higher in patients with SVT only compared to patients with concomitant DVT, suggesting that

TABLE 5 Characteristics of patients with 3-month venous thromboembolism events.

No.	Initial treatment	3-mo outcome	VTE risk factors
1	No treatment	Contiguous proximal DVT[a]	Recently hospitalized
2	NSAIDs	Noncontiguous distal DVT[a]	None
3	No treatment	Contiguous proximal DVT[a]	Previous sclerotherapy
4	NSAIDs	Contiguous proximal DVT[a]	Recent travel
5	Low-dose anticoagulation	Noncontiguous distal DVT[a]	None
6	NSAIDs	Noncontiguous proximal DVT	Previous SVT
7	NSAIDs	Noncontiguous distal DVT[a]	None
8	No treatment	Noncontiguous distal DVT[a]	Recent trauma
9	NSAIDs	Noncontiguous distal DVT	Active cancer
10	Low-dose anticoagulation	Noncontiguous distal DVT, PE	None
11	NSAIDs	Noncontiguous proximal DVT, PE	Known thrombophilia, previous SVT and DVT

DVT, deep vein thrombosis; NSAID, nonsteroidal anti-inflammatory drug; PE, pulmonary embolism; SVT, superficial vein thrombosis; VTE, venous thromboembolism.
[a]Asymptomatic event.

SVTs that develop in "normal," nonvaricosed veins may be associated with a higher risk of DVT.

Given the paucity of high-quality evidence to support the standard of care for patients with SVT, it is not surprising that we observed significant heterogeneity in the treatment and follow-up of patients diagnosed with SVT more than 3 cm from the deep vein junction at inclusion. Criteria used to select management strategies for patients could not be determined from the chart review; however, at the time of diagnosis, only approximately a third of patients received any anticoagulation (ranging from prophylactic to full dose), while the remainder were treated conservatively, including receiving no treatment. This may explain why approximately two-thirds of patients underwent a planned serial US within 14 days of their SVT diagnosis, which yielded 24 asymptomatic events, 4 (4.1%) of which were DVTs. Thus, 2 broad management plans were generally identified; patients were either managed only with anticoagulant treatment (no serial US unless clinically indicated by worsening of symptoms) or received conservative management and monitored via serial US (often more than 1). Within the limitations of our study design, and despite the likelihood that patients with fewer VTE risk factors were more often selected for conservative management, the risk of further thrombotic complications appeared higher in those treated conservatively than in patients treated with anticoagulants. Remarkably, the rate of significant VTE of 8% in the conservative group vs 0% in the high-dose and intermediate-dose anticoagulant groups gives pause and may suggest the need to evaluate the use of acute DVT doses in patients with SVT. These findings are consistent with a study following patients with SVT long term when they were not treated routinely with anticoagulation, which showed a high risk of DVT and PE, especially within the first 3 months [19]. Furthermore, the lack of standardized treatment, also observed outside of our study [8,13–15], is likely a consequence of the lack of large randomized controlled trials studying treatments for SVT [8,9], with the exception of the "Comparison of Arixtra in Lower Limb Superficial Vein Thrombosis with Placebo" (CALISTO) and "Superficial Phlebitis Treated for Forty-five Days with Rivaroxaban versus Fondaparinux" (SURPRISE) studies [20,21].

Finally, over the 3-month follow-up period, we found that 56 (29.2%) patients suffered at least 1 thrombotic complication for a total of 69 events, including 11 (5.9%) DVTs (5 proximal and 6 distal) and 2 (1.1%) PEs. Of the 11 patients who suffered VTE events, 4 (36.4%) had no significant risk factors, and only 1 (9.1%) had cancer. Most notably, 9 (81.8%) of these patients had initially been treated conservatively, and the other 2 were treated with low-dose anticoagulation. These results are consistent with previous literature [4] and contribute to the growing pool of evidence that SVT is not a benign disease, especially since we excluded follow-up patients with SVT within 3 cm of the SFJ/SPJ, which have been shown to be associated with an elevated risk of VTE [8]. We also report a significantly higher overall complication rate in our cohort compared to the rates reported in previous clinical trials (29.2% vs 0.9%-5.9%) [4–6,19]. In the CALISTO and SURPRISE studies using low-dose anticoagulant therapy, the primary efficacy outcomes only included symptomatic extensions and recurrences of SVT along with death, symptomatic PE, and DVT [20,21]. In contrast, we included asymptomatic SVT recurrence and extension, the clinical relevance of which is unknown and accounts for many of our 3-month outcomes, which likely explains this discrepancy. Moreover, the detection of these asymptomatic events is likely a result of our inclusion of serial US results, which were not included in these larger randomized controlled trials [20,21].

Due to the inherent limitations of a chart review, the description of the clinical presentation collected from clinical notes and US reports was not standardized across physicians, leading to some loss of data when clinical descriptions and quantitative measurements were lacking or inadequate. Notably, since not all US reports commented on the distance of the SVT from the SFJ/SPJ, and SVT with unknown

distance from the junction was included in the 3-month follow-up analysis, it is possible some patients with SVT near the junction were included in the analysis. Another limitation of retrospective reviews included not collecting data on patients' race/ethnicity as it was not systematically recorded in the electronic medical records of our center. Thus, we could neither report this information nor comment on how generalizable our results are to patients from various racial or ethnic backgrounds. Furthermore, this study includes the practices of a single center, and we recognize that this may not reflect upon how other centers manage patients with SVT, although the heterogeneity has been recognized across various international centers [8,13–15]. In addition, since patients were ascertained from US reports, we cannot know the outcomes of patients diagnosed with SVT who did not undergo US, and we do not know what proportion of patients with SVT this group represents. Moreover, the lack of formal referral criteria for SVT represents a possible referral bias. It is possible that we selected a higher-risk group if patients with minor symptoms were managed without US or thrombosis referral. However, in our center, the practice of routine US in these patients has been established for many years, and as such, we expect most patients with a suspected SVT to have undergone an US. Data on the duration of anticoagulation offered during the follow-up period was not collected, given the lack of standardized recommendations on this. Other limitations include the lack of outcome adjudication as well as small sample size, which limits our ability to evaluate the potential risk factors for VTE recurrence. To our knowledge, this is the first study considering the clinical presentation of patients when evaluating the risk of concomitant DVT at the time of presentation.

5 | CONCLUSION

In conclusion, the results of this study support the use of initial ultrasonographic examination of the deep and superficial venous systems in all patients with clinically suspected SVT, irrespective of their clinical presentation, to rule out the presence of an asymptomatic concomitant DVT and to measure the distance of the SVT from the junction of the deep vein system. Moreover, our study highlights the high risk of complications associated with conservative management in patients with isolated SVT, and our results suggest that clinical trials evaluating treatment doses of anticoagulants are warranted. The role of monitoring the thrombus via serial US remains unclear as the yield seems to depend on the treatment strategy.

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ETHICS STATEMENT

Ethics approval was received from the Ottawa Health Science Network Research Ethics Board prior to study initiation.

AUTHOR CONTRIBUTIONS

M.-E.M., L.D., P.W., and G.L.G. developed the study design and data collection form. M.-E.M. performed data extraction and data analysis and wrote drafts of the manuscript. All authors reviewed the manuscript's drafts and approved the paper's final version.

RELATIONSHIP DISCLOSURE

G.L.G. report lectures fees from and has served on the advisory boards of Bayer, Bristol-Meyer-Squibb, Leo Pharma, Pfizer, Sanofi, Stago. All other authors have no conflicts to report.

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