

Superficial Vein Thrombosis and Thromboembolic Events in a Patient Cohort undergoing Small Saphenous Vein Surgery

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Abstract

Background: The primary aim was to retrospectively assess the incidence of superficial vein thrombosis in a patient cohort that had undergone surgery of the Small Saphenous Vein (SSV) due to Chronic Venous Disease (CVD).

Material and Methods: 76 consecutive, unselected patients who had undergone primary SSV surgery for CVD over a four year time span were included in this retrospective study. Diagnosis of superficial vein thrombosis of the SSV and of Deep Venous Thrombosis (DVT) was made by means of patient history and preoperative Duplex Ultrasonography Findings (DUS).

Results: In 28 patients (36.8%) (36 legs) a condition after superficial vein thrombosis was diagnosed. Thromboembolic complications such as deep venous thrombosis and Pulmonary Embolism (PE) occurred in 11 of 76 patients (14.4%). All of these patients suffered from superficial vein thrombosis.

Conclusion: We conclude that studies on superficial vein thrombosis of the SSV and possible thromboembolic complications are rarely found in the literature. The morbidity associated with SSV insufficiency may be underestimated.

Introduction

Superficial vein thrombosis of the Great Saphenous Vein (GSV) is clearly better documented in the literature than superficial vein thrombosis of the Small Saphenous Vein (SSV). The incidence of Deep Venous Thrombosis (DVT) in association with superficial vein thrombosis of the lower limbs has been described to be up to 65% [1-6]. The highest value comes from a study on superficial vein thrombosis of the small saphenous vein [2].

In our study the primary aim was to retrospectively assess the incidence of superficial vein thrombosis in a patient cohort that had undergone SSV surgery due to Chronic Venous Disease (CVD) [1]. The secondary aim was to assess the incidence of thromboembolic events (deep venous thrombosis and pulmonary embolism) within the patient cohort.

The tertiary aim was to assess if the incidence of superficial vein thrombosis in the SSV is influenced by age, gender, cardiovascular risk factors or malignant disease within this patient cohort.

Material and Methods

This study was approved by the local (Kantonal) Ethics Committee (KEK BE 357/15). Retrospectively, 76 consecutive, unselected patients (91 legs) who had undergone primary Small Saphenous Vein (SSV) surgery due to symptomatic varicose veins and other forms of CVD over a four year time span (1st November 2011-31st October 2015) at the Hospital of Thun (Switzerland) were included in the study. All patients had given their informed written consent. Each patient had undergone preoperative duplex sonography as part of the usual preoperative investigations (Acuson Aspen, Acuson Corporation, Mountain View CA, USA) performed by one of two at the same university hospital trained angiologists (vascular specialists). Diagnosis of superficial vein thrombosis of the SSV and condition after DVT was made by means of patient history and preoperative Duplex Ultrasonography Findings (DUS) [1,7]. Preoperatively, CEAP class was assessed for each leg according to the so called basic CEAP classification. Cardiovascular risk factors such as smoking, diabetes, arterial hypertension, hypercholesterolemia and obesity as well as the presence of a positive family history for chronic venous disease and a history of malignant disease were noted for all patients.

Operations were performed under spinal or under general anesthesia. A small transverse incision was made in the popliteal fossa over the saphenopopliteal junction which had been marked

Table 1: Gender and age distribution with CEAP classes for each leg.

Gender		Age (years)				
	n'	Female	Male	Mean	St. Deviation of age	St. Error of mean
CEAP 2	27	22	5	45.93	14.86	2.86
CEAP 3	32	16	16	57.84	11.85	2.09
CEAP 4	28	13	15	57.29	10.56	1.99
CEAP 5	1	0	1	77	0	0
CEAP 6	3	2	1	60.33	23.57	13.61
Total	91	53	38	59.68	12.17	4.11

n' = legs

preoperatively using duplex sonography. The incompetent SSV was stripped from proximal to the distal point of valve insufficiency (Vast rip, Astra Tech, Mölndal, Sweden). If the diameter of the SSV was measured then just before the high ligation, at the proximal part of the SSV. The stripped vein was opened longitudinally and the surgeon and the scrub nurse independently counted and assessed the valves. The valve assessment was prospectively undertaken. The quality of the valve was determined according to the Valve Disease Class (VDC): a for open surgery modified VCT (Valve, Cusp, Tributary) classification system as defined in the references [8,9]. Veins with a previous history of superficial vein thrombosis or DUS finding of superficial vein thrombosis were excluded from valve assessment only as postphlebotic changes of the valves cannot be securely differentiated from non-postphlebotic changes within the C-classes. Perforating veins were ligated according to the preoperative duplex sonography and stab avulsions were performed as preoperatively marked. Diagnosis of postoperative DVT or PE was made by duplex sonography or computed tomography of the chest respectively. All patients received Low Molecular Weight Heparin (LMWH) in a prophylactic dose for 10 days after the procedure and compression stockings class II day and night for 10 days and thereafter for two weeks during the day only.

Statistical comparison was performed by the Wilcoxon signed-rank test, Fisher's exact test and logistic regression. Differences were

considered statistically significant at a level of $p < 0.05$. The software used was S-Plus Professional 6.2, Insightful Corp, Seattle, USA.

Results

A total of 76 patients were treated (91 legs). The gender and age distribution within the CEAP class is shown in Table 1. In 28 patients (36.8%) (36 legs) a condition after superficial vein thrombosis was diagnosed; 17 patients (22.3%) had a positive history for superficial vein thrombosis, 6 patients (7.9%) patients by DUS and 5 patients (6.6%) by both history and DUS. There was no statistical evidence ($p < 0.05$) for an association between superficial vein thrombosis and the CEAP class.

Thromboembolic complications such as deep venous thrombosis and pulmonary embolism occurred in 11 of 76 patients (14.4%). All of these patients suffered from superficial vein thrombosis. DVT was found in 7 of 76 patients and PE in 5 of 76 patients. 4 of the 7 DVT occurred preoperatively and 3 postoperatively. All 5 PE occurred preoperatively. Only one patient suffered from both DVT and PE as shown in Figure 1.

Of the 28 patients with a superficial vein thrombosis none were orally anticoagulated and three were taking platelet inhibitors (one patient with superficial vein thrombosis by history, one patient with superficial vein thrombosis by DUS and one patient with superficial vein thrombosis by history and DUS).

Of the 48 patients without superficial vein thrombosis 7 patients were orally anticoagulated (for non-thromboembolic indications) and 9 were taking platelet inhibitors.

The cardiovascular risk factors noted in the 76 patients were smoking in 32 patients, diabetes in 5 patients, high blood pressure in 13 patients, high cholesterol in 6 patients, obesity in 22 patients and positive family history in 38 patients. 4 patients had a history of a malignant disease. There was no statistically significant influence of age, gender, any of the cardiovascular risk factors or malignant disease on the incidence of superficial vein thrombosis using the logistic regression and pairwise analyses of the Fisher's exact test. This logistic regression analysis was repeated for the cardiovascular risk factors and female gender in regard to the incidence of superficial vein thrombosis with the additional co variable age. Again none of these factors had a statistically significant influence on superficial vein thrombosis.

It was found that the valve disease class correlated statistically significantly with the increasing C-class of CEAP ($p < 0.01$). The valve

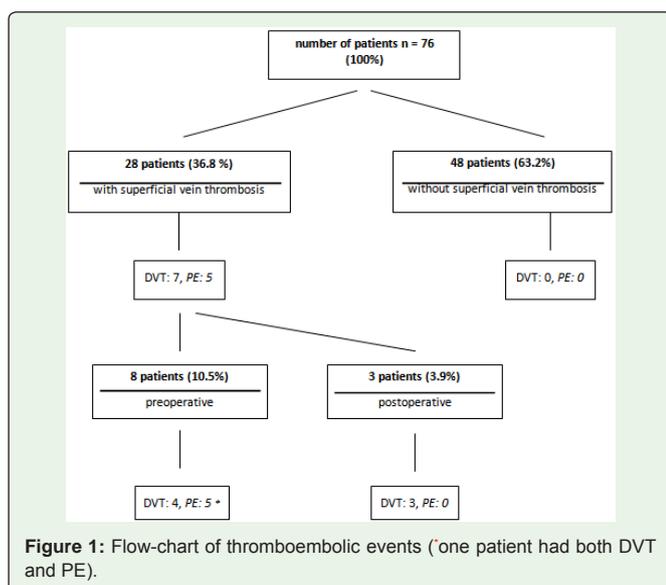


Table 2: Valve Disease Classes (VDC) and CEAP classes per leg.

	n'	VDC 0	VDC 1	VDC 2	VDC 3	VDC 4	VDC 5
CEAP 2	18	3	7	6	2	0	0
CEAP 3	17	1	6	5	4	1	0
CEAP 4	16	0	0	8	4	1	3
CEAP 5	1	0	0	0	0	1	0
CEAP 6	3	0	0	2	1	0	0
Total	55	4	13	21	11	3	3

n'= legs eligible for assessment (available in 55 of 91 cases).

disease class in relation to the CEAP classes is shown for each leg in Table 2.

The assessments of the valves by the surgeons and the scrub nurse were uniform. The overall number of valves per meter of the small saphenous vein was 8.8. It was 8.9 valves per meter SSV for C2 of CEAP, 8.4 for C3, 9.5 for C4, 9.1 for C5 and 6.2 for C6 respectively. The number of valves per meter did not correlate with the C-class (rank correlation test). Neither CEAP status nor valve disease class were significantly higher for the left leg compared with the right leg. Injuries caused by the stripping of the SSV occurred rarely and were easy to recognize as such and to differentiate from chronic changes of the valve.

For 49 patients both the CEAP classification and the diameter of at least one SSV were available. In case of complete data for both SSV we computed the average CEAP classification and the average diameter (since CEAP classification is an ordinal feature, we computed the Spearman's rank correlation of CEAP classification and diameter of the SSV). This rank correlation coefficient turned out to be 0.3141 with a corresponding two-sided p-value of 0.0267. This shows that there is a weak but significant positive association between CEAP classification and diameter of SSV.

Sural nerve injury was observed in 2 of 71 patients (2.8%) (2 legs) coming to the 10 day follow-up. 5 patients came from far away and had their follow-up with the local doctor. 71 of 76 patients represent a follow-up rate of 93.4%. The two patients with sural nerve injury displayed near full recovery after 4 and 6 months respectively.

Discussion

To our knowledge, this is the first study investigating the incidence of superficial vein thrombosis in SSV according to the patients history and the preoperative duplex sonography. The present study showed a 36.8% incidence of superficial vein thrombosis in patients undergoing small saphenous vein surgery.

11 of 76 patient (14.4%) had pre-postoperative thromboembolic complications such as DVT or PE. All of these 11 patients were suffering from superficial vein thrombosis. The presence of superficial vein thrombosis did not seem to be associated with the CEAP class. No statistically significant correlation between cardiovascular risk factors and superficial vein thrombosis was detected.

There are some limitations to our study. This cohort of patients represents patients undergoing SSV surgery only - and not patients with SSV insufficiency in general. Our specimens contained diseased SSV only. Non-diseased SSV was not stripped and therefore we do

not have a control group for a comparison of non-diseased SSV in our study. In a non-diseased SSV there may be more valves per meter present than found in a diseased SSV [9].

Making the diagnosis of superficial vein thrombosis from the patients history may be dependent on the specialist and is therefore not accurate. However, in the past superficial vein thrombosis in our patients may have been diagnosed and treated outside our hospital with a DUS report that was not accessible for our study. Duplex sonographic differentiation between degenerative valve destruction and prepost-phlebotic valve destruction is often not possible, therefore patients with superficial vein thrombosis were excluded from valve assessment only. In our retrospective study it was not possible to perform a histopathological examination of the valves to correlate with the history and DUS findings of a superficial vein thrombosis. The intra-operative evaluation of the specimens was made by the same surgeon but the other team members changed. The inter-rater reliability was not assessed. The valve assessment was a prospectively undertaken element of our study. This very small amount of data had been prospectively collected but we decided not to publish it in isolation.

In the literature there is one study particularly focusing on superficial vein thrombosis in the SSV [2]. In this prospective non-randomized study 33 cases of superficial vein thrombosis in the SSV were assessed. They detected an association of superficial vein thrombosis in the SSV with deep venous thrombosis (by duplex scanning) in 65.6% of the cases and conclude that small superficial vein thrombosis in the SSV is more often associated with deep venous thrombosis than previously thought [2]. These patients suffered from active superficial vein thrombosis when duplex sonography was performed. This may help to explain why their cohort showed a much higher percentage of deep venous thrombosis compared to our cohort. Aetiology of superficial vein thrombosis of the SSV did not consist of CVD only in their study. Some patients had no CVD. Risk factors other than CVD may result in a higher risk for DVT in SSVs. Finally, all our patients received a postoperative thromboembolic prophylaxis with LMWH for at least 10 days. In general other studies assessing superficial vein thrombosis have not made a distinction between SSV and GSV superficial vein thrombosis - therefore conclusions specifically valuable for SSV superficial vein thrombosis are not available [3-6]. In one study on GSV an unusually high association between superficial vein thrombosis in the GSV and DVT was detected in 44% of the patients [5]. It was still lower than for SSV. CVD has been described as a risk factor for SSV and GSV thrombosis together with other risk factors such as trauma, blood and coagulation disorders, malignant and connective tissue diseases only to mention some of them [4-6]. In one of these studies the aetiology of superficial vein thrombosis was analysed: CVD was the only aetiological risk factor for superficial vein thrombosis in 58.5% of the cases, CVD together with other risk factors for superficial vein thrombosis was described in 22.8%, in 13.2% no CVD was present and in 5.2% the aetiology for superficial vein thrombosis remained unclear [3]. A recent study found a significantly higher prevalence of superficial vein thrombosis in patients with CEAP class C4 to C6 than in CEAP class C1 to C3 [10]. In our study all patients had the risk factor CVD.

Summary

In summary we conclude that studies on superficial vein thrombosis of the SSV and its thromboembolic complications are rarely found in the literature. The morbidity associated with SSV insufficiency may be underestimated. Patients with known chronic SSV insufficiency should be carefully informed about superficial vein thrombosis and thromboembolic complications in order to avoid or early detect them and its thromboembolic complications.

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