ORIGINAL ARTICLE

CONTENTS

Surgical prevention of venous thromboembolic complications of thrombosis in the basin of the small saphenous vein

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ABSTRACT

Aim: To evaluate the results of surgical prophylaxis of venous thromboembolic complications in superficial vein thrombosis in the basin of the small saphenous vein.

Materials and Methods: The study evaluated the results of treatment of 134 patients with superficial vein thrombosis in the basin of the small saphenous vein, who were divided into two groups: Group I - 86 (64.2%) patients who were operated on for thrombosis in the basin of the small saphenous vein and Group II - 48 (35.8%) patients who received only conservative treatment.

Results: In the postoperative period, no recurrence of superficial or deep vein thrombosis and pulmonary embolism was detected in patients of group I within 12 months. The regression of symptoms of chronic venous insufficiency was noted in 66.7% of patients, and no patient was diagnosed with a decompensated form of chronic venous insufficiency. Over the course of the year, 12.2% of patients in group II showed an increase in the manifestations of chronic venous insufficiency. Recurrence of superficial or deep vein thrombosis in group II was detected in 14.6% and 4.9% of patients, respectively.

Conclusions: Surgical treatment of superficial vein thrombosis in the basin of the small saphenous vein prevented pulmonary embolism and recurrence of venous thrombosis in all patients, and in 66.7% of patients contributed to the regression of decompensated forms of chronic venous insufficiency. Recurrence of superficial and deep vein thrombosis during conservative treatment was observed in 14.6% and 4.9% of cases, respectively, which led to pulmonary embolism in 4.9% of patients.

KEY WORDS: superficial vein thrombosis, saphenopopliteal junction, surgical intervention, conservative treatment, pulmonary embolism

Wiad Lek. 2025;78(4):813-820. doi: 10.36740/WLek/203891 DOI

INTRODUCTION

The treatment of superficial vein thrombosis as a complication of varicose veins is an ongoing debate among the surgical community. There is a widespread belief in the benign clinical course of superficial vein thrombosis, which requires only symptomatic treatment [1].

The German registry of superficial venous thrombosis shows that conservative treatment remains the only treatment, but there is no standardized regimen and duration of anticoagulant therapy [2]. Patients are prescribed heparin, oral anticoagulants, or no anticoagulants at all [2]. At the same time, the authors note that despite the high percentage of anticoagulant use, there is a significant risk of venous thromboembolic complications and recurrent thrombosis within three months [2], which reaches up to 10.2% of cases [3].

Bauersachs R. et al. (2021), based on a prospective study (INSIGHTS-SVT) involving 1150 patients with acute isolated superficial vein thrombosis, reported that despite different anticoagulant therapy, the incidence of pulmonary embolism and its recurrence was 1% and 5%, respectively [4].

The authors' studies differ in the frequency of venous thromboembolic complications in superficial vein thrombosis. In 2016, the authors, based on a meta-analysis of 21 studies including 4358 patients, found deep vein thrombosis in 18.1-18.2% of patients with superficial vein thrombosis [5]. A similar meta-analysis of 11 studies (2484 patients) found pulmonary embolism in 6.9-8.2% of patients with superficial vein thrombosis [5].

A retrospective cohort study conducted by the National Health Insurance Service of Taiwan, which included two huge groups of patients: the main group - 212,984 patients with varicose veins and the control group, which included a similar number of people without varicose veins, revealed a significantly higher risk of deep vein thrombosis and pulmonary embolism in the main group: 6.55 vs. 1.23 cases and 0.48 vs. 0.28 cases per 1000 person-years, respectively [6]. based on data that revealed a significant incidence of deep vein thrombosis in the setting of varicose veins [6].

The incidence of venous thromboembolic complications in superficial vein thrombosis remains high, which refutes the statement about the benign course of the disease [5-8]. Thus, 25% of patients with superficial vein thrombosis have asymptomatic pulmonary embolism [2]. This is confirmed by the common risk factors for deep vein thrombosis and pulmonary embolism, which are also characteristic of superficial vein thrombosis [2, 5, 8, 9]. At the same time, the annual cost of treating such a «benign» disease as superficial vein thrombosis in the United States alone is $3 billion annually [10].

Thus, the issue of treatment of deep vein thrombosis remains controversial. Even with anticoagulation therapy, the incidence of venous thromboembolic complications in superficial vein thrombosis remains high.

AIM

To evaluate the results of surgical prophylaxis of venous thromboembolic complications in superficial vein thrombosis in the basin of the small saphenous vein.

MATERIALS AND METHODS

The study evaluated the results of surgical and conservative treatment of 134 patients with superficial vein thrombosis in the basin of the small saphenous vein. Depending on the method of treatment, patients were divided into two groups:

- Group I (main) - 86 (64.2%) patients who were operated on for thrombosis in the basin of the small saphenous vein;
- Group II (control) - 48 (35.8%) patients who received only conservative treatment.

The diagnostic algorithm for the examination of patients included a general blood and urine test, glycemic testing, biochemical blood tests, coagulation test, and detection of hepatitis markers. If necessary, additional laboratory tests were prescribed. Particular importance was attached to ultrasound examination of patients. An electrocardiogram, consultation with a cardiologist, and ultrasound examination of the veins of both lower extremities and pelvis were considered mandatory. The latter was performed in all patients without exception at their initial visit for medical care, which was repeated in patients of group I immediately before surgery, and subsequently in patients of both groups before discharge from the hospital. In addition, in 3 (4.6%) patients of group I and 5 (22.7%) patients of group II , ultrasound examination was performed more often during inpatient treatment, as indicated.

The statistical processing of the study results was performed using Microsoft Excel 2010 computer programs with the Statistica 5.0 for Windows application package. The mean values and relative indicators were compared using Mann-Whitney criteria and Pearson's parametric correlation analysis.

The study was conducted in accordance with the provisions of the Declaration of Helsinki of the World Medical Association «Ethical Principles for Medical Research Involving Human Subjects» (revision 2008) and approved by the Bioethics Committee of the School of Medicine of the Uzhhorod National University. All patients signed an informed consent to participate in the research work.

RESULTS

All patients underwent ultrasound examination of the veins of both lower extremities during the initial visit for medical care to detect venous thrombosis of the contralateral lower extremity. The superficial, deep and communicating veins of the lower extremity were examined sequentially, including ultrasound examination of the iliac veins and inferior vena cava. The most common cause of superficial vein thrombosis in the basin of the small saphenous vein was varicose veins in 95 (70.9%) patients, post-thrombotic changes in the small saphenous vein or the absence of any pathological changes in the venous wall were detected in 22 (16.4%) and 17 (12.7%) patients, respectively. Pathologic changes in the venous system of the contralateral lower extremity were detected in 45 (33.6%) patients, in particular:

- varicose veins - in 27 (60%);
- post-thrombotic changes in superficial veins - in 5 (11.1%)
- superficial vein thrombosis - in 4 (8.9%)
- deep vein thrombosis - in 8 (17.8%)
- simultaneous thrombosis of superficial and deep veins - in 1 (2.2%) case.

Significant attention was paid to the detection of the sapheno-popliteal junction or its absence during ultrasound examination of the affected limb, in particular, the following anatomical variants of the inflow of the small saphenous vein were found:

- in the popliteal vein (sapheno-popliteal cofemoral) - in 78 (58.2%);
- extension of the small popliteal vein into the vein of Giacomini with a branch to the popliteal vein - in 33 (24.6%);
- extension of the small popliteal vein into the vein of Giacomini without communication with the popliteal vein - in 12 (9.0%);

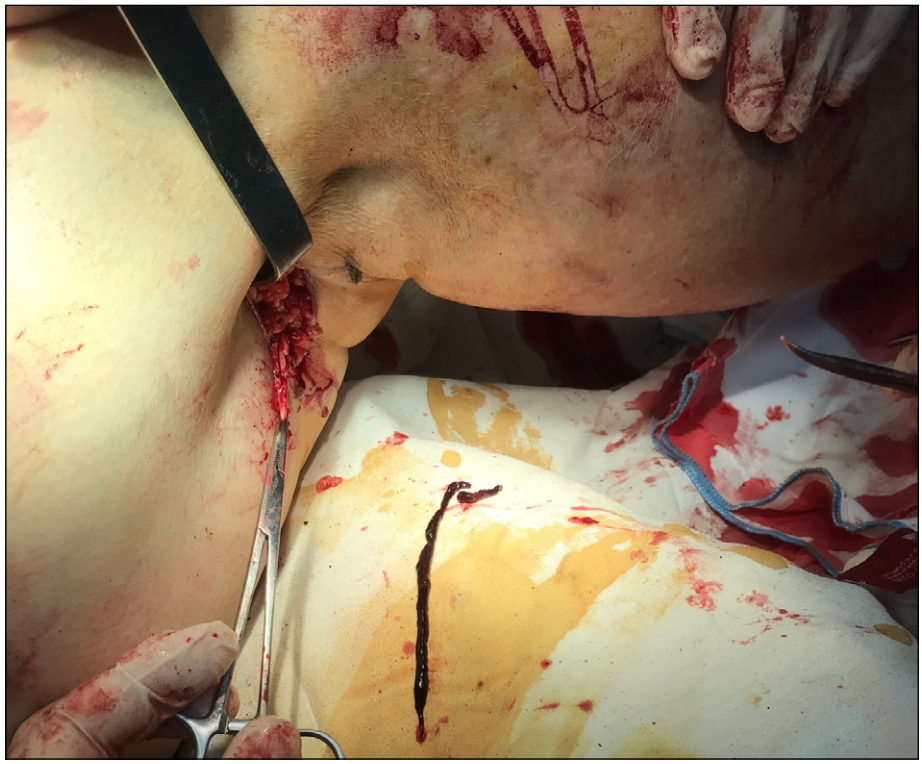

Fig. 1. Treatment of the sapheno-popliteal junction, thrombectomy from the vein of Giacomini.

Fig. 2. Removal of thrombosed tributaries of the small saphenous vein.

- merger of the small saphenous vein with the medial bilateral venous sinus and a single trunk flowing into the popliteal vein - in 3 (2.2%);
- extension of the small saphenous vein into the veins of the muscles of the posterior thigh - in 7 (5.2%);
- inflow of the small saphenous vein into the great saphenous vein - in 1 (0.8%) observation.

Thrombosis of the trunk of the small saphenous vein was detected in 129 (96.3%) of 134 patients, with the apex of thrombotic masses in 82 (63.6%) patients localized in the upper third of the lower leg, and in 18 (14.0%) in the popliteal fossa, which posed a significant threat of venous thromboembolic complications.

Fig. 3. Removal of the thrombosed trunk of the great saphenous vein.

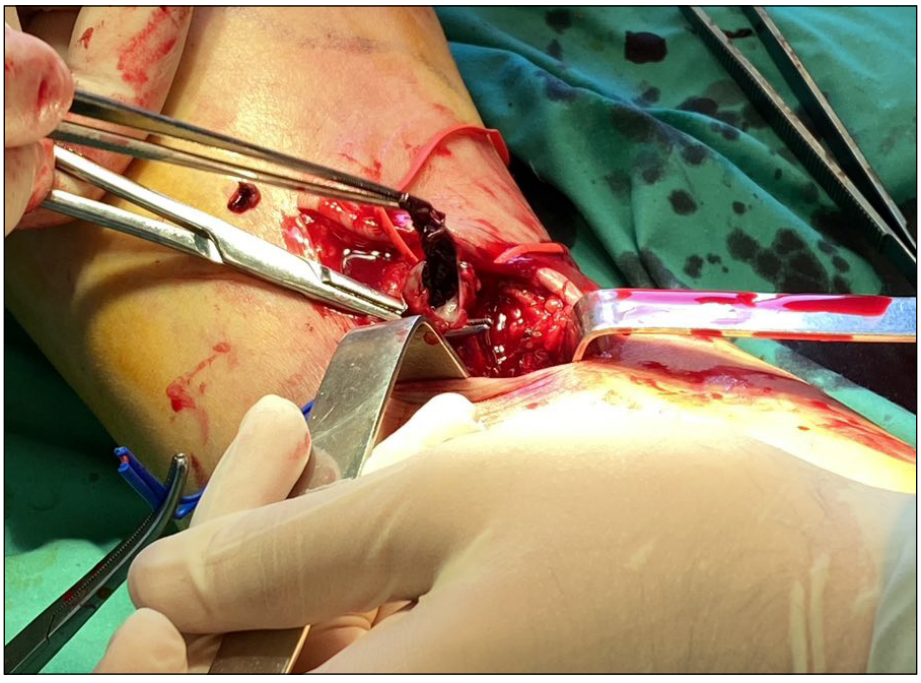

Fig. 4. Open thrombectomy from the popliteal vein.

In 5 (3.7%) of 134 patients, thrombotic lesions of the tributaries of the small saphenous vein were detected without the transition of thrombotic masses to the trunk of the superficial highway. Simultaneous lesions of the trunk of the small saphenous vein and its tributaries were detected in 53 (39.6%), including 10 (18.9%) with thrombotic lesions of the intersaphenous veins connecting the small and large saphenous veins. A combination of thrombotic lesions of the basin of the small and large saphenous veins was detected in 12 (9.0%) of 134 patients, with 92 (68.7%) patients with thrombosis of the small saphenous vein having varicose ectasia in the basin of the large saphenous vein

A patient with thrombosis of the superficial veins of the basin of the small saphenous vein was potentially considered as a candidate for urgent surgical intervention for the effective prevention of venous thromboembolic complications. However, the criteria for exclusion of the patient from the main group were as follows:

- the presence of thrombosis or post-thrombotic changes in the deep veins of the affected limb;

Table 1. Surgical interventions in patients of group I

No.	Surgical intervention	Quantity
1.	Ligation of SPC + phlebectomy of SSV	3
2.	Ligation of the SPC + phlebectomy of the SSV and its tributaries	5
3.	Phlebectomy of SSV and LSV + CE	24
3.	Ligation of SPC + phlebectomy of SSV and LSV + CE	46
4.	TE from the mouth of the SSV + ligation of the SPC + phlebectomy of the SSV and its tributaries	4
5.	TE from the mouth of the SSV + ligation of the SPC+ phlebectomy of the SSV and LSV + CE	1
6.	TE with SV + SPC ligation + phlebectomy of SSV and LSV + CE	2
7.	TE and ligation of the medial bilateral sinus + phlebectomy of the SSV and its tributaries	1
Total:		86

Notes: SPC - sapheno-popliteal connection
SSV - small saphenous vein
CE - crossectomy
LSV - large saphenous vein

- thrombotic lesions of the superficial and/or deep veins of the contralateral limb;
- severe comorbidities and/or contraindications to anesthesia;
- categorical refusal of the patient from the proposed surgery.

In patients of the main group, the surgical intervention involved the removal of the thrombotically affected trunk and tributaries of the small saphenous vein, but in the presence of varicose veins in the basin of the great saphenous vein, the volume of the operation was increased to eliminate valve insufficiency and venous reflux in both superficial highways of the affected limb. Immediately before the surgery, a control ultrasound examination was performed, which included marking the following important anatomical landmarks:

- the place where the small saphenous vein enters the popliteal vein, the medial bilateral venous sinus or the great saphenous vein, extending into the vein of Giacomini or the thigh muscles;
- the course of the trunk of the small saphenous vein;
- localization of failed piercing veins;
- localization of thrombosed and/or varicose tributaries of the small saphenous vein;
- localization of thrombosed and/or varicose intersaphenous veins.

Similarly, thrombosed and/or varicose veins of the great saphenous vein basin were labeled.

The main stages of the surgical intervention were as follows:

- treatment of the sapheno-popliteal junction - in 48 (55.8%) (Fig. 1);
- removal of thrombosed or varicose vein trunk of the small saphenous vein - in 86 (100%);
- removal of thrombosed or varicose tributaries of the small saphenous vein - in 47 (54.7%) (Fig. 2);
- removal of thrombosed or varicose intersaphenous veins - in 7 (8.1%);
- removal of thrombosed or varicose veins and the trunk of the great saphenous vein - in 73 (84.9%) (Fig. 3);
- thrombectomy from the mouth of the small subcutaneous vein, popliteal vein (Fig. 4) or medial bilateral venous sinus - in 5 (5.8%), 2 (2.3%) and 1 (1.2%) cases, respectively.

The main task of surgical treatment in group I was to eliminate the thrombotic process and prevent venous thromboembolic complications. The operation began with ligation of the sapheno-popliteal junction or venous connection of the small saphenous vein with the popliteal vein in its extension into the vein of Giacomini, the next step was the removal of the trunk of the small saphenous vein and, if necessary, its tributaries. In case of spreading thrombotic lesions or varicose changes in the basin of the IVC, crossectomy and phlebectomy of the great saphenous vein and its tributaries were performed.

Patients with the presence of the apex of thrombotic masses at the mouth of the small saphenous vein (n=5) and popliteal vein (n=2) required special attention. Surgical intervention began with open thrombectomy from the mouth of the small saphenous vein or popliteal vein. In both cases, thrombectomy from the popliteal vein was performed without venotomy through the mouth of the small saphenous vein.

In the presence of an open trophic ulcer - in 11 (12.8%) patients of group I, the operation was completed by surgical treatment of the trophic ulcer. Discharge from the trophic ulcer was sent for bacterial culture and antibiotic susceptibility testing. Antibiotic therapy was prescribed for 7 days.

Surgical interventions in patients of group I are presented in Table 1.

In group I, patients in the preoperative period

were prescribed injections of low-molecular-weight heparins in a therapeutic dose to prevent thromboembolic complications, which were continued in the postoperative period until discharge from the hospital with subsequent transfer to oral anticoagulants in a prophylactic dose for 1 month. Along with anticoagulants, complex phlebotropic agents (diosmin 400 mg/day + hesperidin 600 mg/day) and elastic knitwear of compression class II-III were prescribed, depending on the degree of chronic venous insufficiency.

In the immediate postoperative period before discharge from the hospital and at 1 month of follow-up, the following postoperative complications were observed (n=6) serous discharge from the postoperative wound - in 5 (5.8%) patients and marginal necrosis of the postoperative wound - in 1 (1.2%) patient. The average length of hospital stay was 4.8±1.6 days ($p \leq 0.05$). Within 1 month after surgery, trophic ulcers healed in all 11 operated patients. Not a single case of venous thromboembolic complication was noted in patients of group I within 1 month after surgery

Within 12 months after surgery, 78 (90.7%) of 86 patients were followed up. No recurrence of superficial or deep vein thrombosis or pulmonary embolism was noted in any patient during the follow-up year. The regression of symptoms of chronic venous insufficiency was noted in 52 (66.7%) of 78 patients, and no patient was diagnosed with a decompensated form of chronic venous insufficiency.

Conservative treatment in patients of group II consisted of the administration of low-molecular-weight heparins at a therapeutic dose for 10 to 14 days (mean 12.3±1.9 days ($p \leq 0.005$)), followed by transfer to oral anticoagulants at a therapeutic dose for 2 to 5 months (mean 3.2±0.7 months ($p \leq 0.05$)); in addition, complex phlebotropic agents (diosmin 400 mg/day + hesperidin 600 mg/day), non-steroidal anti-inflammatory drugs (paracetamol 500 mg) and elastic knitwear of compression class II - III, depending on the degree of chronic venous insufficiency, were prescribed.

In the presence of a trophic ulcer, compression dressings with antiseptics were prescribed in 5 (10.4%) patients of group II. Discharge from the trophic ulcer was sent for bacterial culture and antibiotic susceptibility testing. Antibiotic therapy was prescribed for 7 days. On average, the period of trophic ulcer healing was 28.4±5.6 days ($p \leq 0.05$).

Conservative treatment in patients of group II was mainly performed on an outpatient basis - 39 (81.3%) of 48 patients. Inpatient treatment for 5-7 days was required in patients (n=9) with severe comorbidities.

We managed to follow up 41 (85.4%) of 48 patients for 12 months. No patient showed regression of chronic venous insufficiency symptoms. In 5 (12.2%) patients, there was an increase in the manifestations of chronic venous insufficiency, with 4 patients developing trophic ulcers during the year. Recurrence of superficial or deep vein thrombosis was detected in 6 (14.6%) and 2 (4.9%) patients, respectively. In 1 (2.4%) patient, simultaneous thrombosis of superficial and deep veins of the affected limb was observed. Pulmonary embolism was detected in 2 (4.9%) patients, including 1 patient who died.

DISCUSSION

The high incidence of venous thromboembolic complications in superficial vein thrombosis is explained by the transition of thrombotic masses to the deep venous system through the saphenofemoral or sapheno-popliteal junction [5, 11], so the question of treatment of superficial vein thrombosis localized in the area of the saphenofemoral or sapheno-popliteal junction remains open [12]. Casian D. et al. (2022) conducted a prospective study comparing the results of conservative and surgical treatment of superficial vein thrombosis [13]. The authors treated 190 patients and concluded that surgical methods are not inferior to anticoagulant therapy [13]. Opponents of surgical treatment of superficial vein thrombosis argue that a high risk of pulmonary embolism is associated with the occurrence of deep vein thrombosis after surgical treatment of varicose veins [14]. Therefore, retrospective studies that do not take into account the results of varicose veins treatment can be misleading because they do not take into account the actual number of venous thromboembolic complications [15, 16]. At the same time, European guidelines state that the incidence of venous thromboembolic complications in patients almost does not depend on the presence of varicose veins [17, 18].

At the same time, other authors claim a decrease in the incidence of venous thromboembolic complications in patients with varicose veins after its surgical treatment [19], according to some reports, the risk of postoperative deep vein thrombosis is below 1%, although the literature data vary considerably [20, 21]. In addition, the absence of systematic ultrasound examination of patients in the postoperative period after open or endovenous interventions does not allow us to estimate the actual incidence of venous thromboembolic events [22].

Popovych Y.M. and co-authors (2023) state that the introduction of surgical treatment of superficial vein thrombosis effectively prevented the recurrence of the

thrombotic process in the superficial and deep veins of the lower extremity, pulmonary embolism, while in isolated conservative treatment their frequency was 5.1%, 3.4% and 3.4%, respectively [11]. In addition, active surgical tactics in patients with superficial vein thrombosis reduced the incidence of decompensated chronic venous insufficiency from 27.1 to 7.0%, and the manifestations of postthrombotic syndrome in the deep veins of the lower extremity from 100 to 3.7% [11]

Ultrasound monitoring of patients treated with anticoagulant therapy for superficial vein thrombosis during the first week after diagnosis revealed a tendency for the thrombotic process to spread proximally and distally in 23.1% and 9.6% of cases, respectively [23]. The ultrasound proximal and distal boundaries of the thrombotic process exceeded the clinical ones by an average of 15.26±1.21 cm and 7.94±1.32 cm, respectively [23]. In all patients with progression of the thrombotic process, the thrombotic masses were disorganized, and when they spread to the superficial venous highway, an unfixed apex of the thrombotic masses was detected in 85.7% of cases [23].

Thus, the issue of surgical prevention of venous thromboembolic complications in superficial vein thrombosis remains unexplored.

CONCLUSIONS

1. Surgical treatment of superficial vein thrombosis in the basin of the small saphenous vein can effectively prevent pulmonary embolism and recurrence of venous thrombosis in all patients, and in 66.7% of patients it promotes regression and prevents the development of decompensated forms of chronic venous insufficiency.
2. Recurrence of superficial and deep vein thrombosis during conservative treatment was observed in 14.6% and 4.9% of cases, respectively, and a simultaneous combination of superficial and deep vein thrombosis was detected in 2.4% of patients, which led to pulmonary embolism in 4.9% of patients.
3. Conservative treatment in no case led to a regression of chronic venous insufficiency, and in 12.2% of the observations, decompensated forms of chronic venous insufficiency were observed.

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The work was carried out within the framework of the research topic of the Department of Surgical Diseases «Venous hypertension and arterial insufficiency: diagnostics, treatment, prevention» (State Registration No. 0120U100405). Implementation period: 2020 – 2024.

CONFLICT OF INTEREST
The Authors declare no conflict of interest

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RECEIVED: 20.12.2024
ACCEPTED: 22.03.2025