

Ultrasound assessment of the risk of venous thromboembolic complications in thrombosis of varicose transformed tributaries of the great saphenous vein

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ABSTRACT

Aim: To evaluate the ultrasound criteria for venous thromboembolic complications in patients with thrombosis of varicose veins of the tributaries of the great saphenous vein (GSV).

Materials and Methods: The results of ultrasound examination of 52 patients with thrombosis of varicose veins of the tributaries of GSV were analyzed. The indicators of venous hemodynamics were compared with the control group (CG) (n=32).

Results: Varicose transformation of GSV and failure of its valvular apparatus were detected in 44 (84.6%) patients, in 8 (15.4%) patients the superficial venous highway was intact. Vertical reflux was diagnosed in varicose ectasia of GSV: local reflux in 14 (31.8%), widespread reflux in 14 (31.8%), and total reflux in 16 (36.4%) patients. The diameter of GSV in tributary varicothrombophlebitis was 8.9 ± 0.27 mm ($p < 0.05$ vs. CG) and 11.2 ± 0.25 mm ($p < 0.05$ vs. CG) in the horizontal and vertical positions, respectively. The proximal and distal borders of thrombosis exceeded the clinical ones by 15.26 ± 1.21 cm ($p < 0.05$) and 7.94 ± 1.32 cm ($p < 0.05$), respectively. The spread of tributary thrombophlebitis to the superficial venous highway was detected in 14 (26.9%) patients, among whom 12 (85.7%) patients had unfixed apices of thrombotic masses.

Conclusions: The results obtained convincingly demonstrate the need for early ultrasound examination of patients with tributary thrombophlebitis, which allows to identify the real limits of the thrombotic process, timely diagnose the transition of the thrombotic process to superficial and deep venous lines, effectively predict the risk of venous thromboembolic complications and choose the optimal surgical tactics.

KEY WORDS: superficial vein thrombosis, venous thromboembolic complications, varicose transformation, great saphenous vein

Wiad Lek. 2024;77(5):1004-1010. doi: 10.36740/WLek202405120 DOI

INTRODUCTION

Thrombosis of superficial veins in 59-90% of cases is a complication of varicose veins [1-3]. According to the STEPH and SEMERGEN studies, the thrombotic process occurs in 50 – 80% of cases in the great saphenous vein (GSV), in 30-40% – in the tributaries of the great saphenous vein, and in 11-20% – in the small saphenous vein [1-3]. When it occurs in the tributaries of GSV and, with the progression of the disease, thrombosis quickly spreads to the superficial and deep venous main veins [4]. This is facilitated by common risk factors for superficial and deep vein thrombosis [2, 5-7]. Thus, the incidence of deep vein thrombosis and pulmonary embolism in patients with superficial vein thrombosis is 2.6 – 24.6% and 0.5 – 13.0% of patients, respectively [1, 2, 4, 5, 8-10].

Despite this, most researchers do not pay the necessary attention to superficial vein thrombosis, considering it a mild and minor disease [2, 5, 6, 11], although the clinical diagnosis of this pathology is not difficult and the diagnosis is made at the outpatient stage [1, 2, 5].

At the same time, the clinical diagnosis is not accurate, it does not allow to identify the nature, localization and boundaries of thrombotic masses, to exclude the presence of transfascial thrombosis [4, 5, 11]. Ultrasound examination is indicated for all patients with suspected superficial vein thrombosis without exception [5, 8, 12, 13], but ultrasound monitoring is not required after the diagnosis is made [14].

According to a retrospective cohort study conducted in Spain, which included 1166 patients with isolated superficial vein thrombosis of the lower extremities, 24.4% of patients already had a history of venous thromboembolic events [9]. Within 6 months from the time of detection of superficial vein thrombosis, venous thromboembolic complications were detected in 8.9%, of whom 1.4% died [9]. At the same time, ultrasound examination was performed in only 60.3% of patients, and anticoagulant therapy was prescribed for 22 days in 77% of patients [9]. A number of other randomized trials recommend prescribing anticoagulant therapy only in case of ultrasound evidence of thrombotic masses

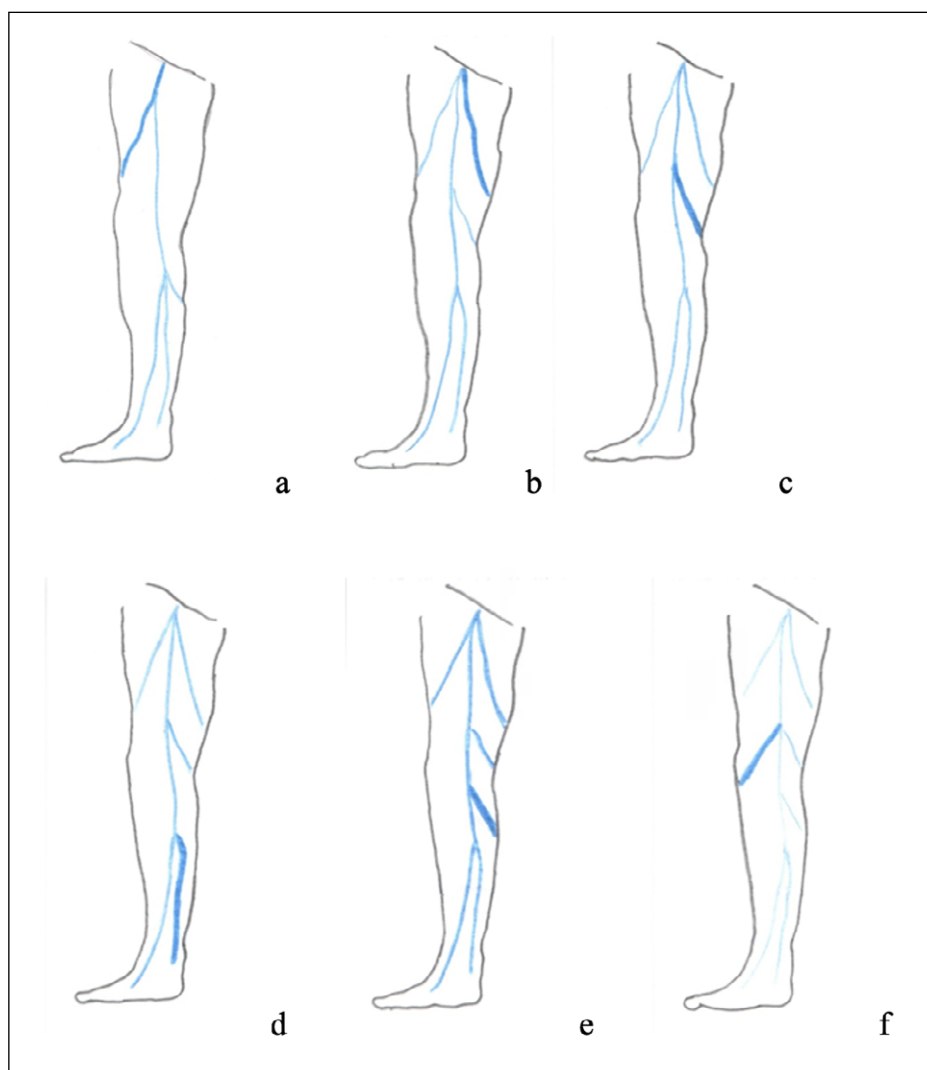


Fig. 1. Localization of thrombosis in varicose transformation of the tributaries of GSV: a) lateral accessory branch; b) medial accessory branch; c) medial intersaphenous vein of the thigh; d) Leonardo's vein; e) medial intersaphenous vein on the lower leg; f) anterior popliteal tributary of the GSV.

spreading to the sapheno-femoral and saphenopopliteal mouths, in other cases, researchers recommend the administration of low-molecular-weight heparins in prophylactic doses, non-steroidal anti-inflammatory drugs and compression garments [2, 5, 8].

Thus, ultrasound criteria for the risk of venous thromboembolic complications in thrombosis of superficial varicose veins play an important role in the choice of surgical tactics.

AIM

To evaluate the ultrasound criteria for venous thromboembolic complications in patients with varicose vein thrombosis of the transforming tributaries of GSV.

MATERIALS AND METHODS

The paper analyzes the results of ultrasound examination of 52 patients with thrombosis of varicose transformed tributaries of GSV treated from May 2020

to December 2023. The age of patients ranged from 23 to 67 years and averaged age was (mean \pm standard error) 34 ± 1.7 years. The gender distribution was 38 (73.1%) women and 14 (26.9%) men. The algorithm of outpatient examination of patients included general blood and urine tests, blood sugar, blood biochemical parameters, coagulogram, ultrasound examination of the veins of the lower extremities (Philips CX-50, Philips Ultrasound Inc., USA). Indicators of venous hemodynamics during ultrasound examination were compared with the control group ($n=32$).

Ultrasound methods of examination of the lower extremity veins are the gold standard for the diagnosis of varicose veins. Ultrasound examination was performed consistently to assess the condition of the superficial and deep venous systems, as well as the penetrating veins of the lower extremity. The examination was completed with an ultrasound examination of the contralateral limb. The examination was performed in a vertical and horizontal position. Vein patency, diameter (in mm), presence of varicose transformation, capacity

Table 1. Venous hemodynamics in tributary varicothrombophlebitis

Ultrasonography of the main line	Varicose transformation GSV		Valves failure GSV			Reflux GSV			GSV barrel diameter (mm) on Valsalva sample				
	local	diffuse	no	yes	no	local	widespread	total	no	main group		control group (n=32)	
										vertically	horizontally	vertically	horizontally
medial additional branch (n=11)	3	5	3	8	3	3	3	2	3	8,3±0,21*	9,5±0,25*	2,3±0,12	3,4±0,19
lateral additional (n=5)	1	4	-	5	-	1	3	1	-	8,6±0,22*	10,1±0,23*	2,6±0,17	3,2±0,12
external vena cava vein (n=2)	1	-	1	1	1	1	-	-	1	8; 11	10; 12	2,7±0,32	2,9±0,41
superficial peritoneal vein (n=1)	1	-	-	1	-	1	-	-	-	7	10	2,6±0,24	3,1±0,42
internal superficial enveloping vein of the thigh (n=3)	1	1	1	2	1	1	-	1	1	6; 9; 10	7; 10; 11	2,9±0,23	3,2±0,27
anterior popliteal tributary (n=2)	-	2	-	2	-	-	-	2	-	7; 10	10; 12	3,1±0,72	3,3±0,56
Leonardo's vein (n=21)	5	14	2	19	2	5	5	9	2	10,2±0,25*	11,3±0,31*	3,2±0,26	3,5±0,21
anterior arch vein of the shin (n=7)	2	4	1	6	1	2	3	1	1	9,3±0,22*	10,7±0,24*	2,9±0,34	2,9±0,42
Total (n=52)	14	30	8	44	8	14	14	16	8	8,9±0,27*	11,2±0,25*	3,8±0,31	4,8±0,27

Comment.: * – p<0,05 (vs. control group).

of the valve apparatus, presence of venous reflux and failed penetrating veins were assessed. Special attention was paid to the examination of the deep venous system to exclude thrombotic occlusion or post-thrombotic changes.

The study was conducted in accordance with the provisions of the Helsinki Declaration 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 Uzhhorod National University. All patients signed an informed consent to participate in the research work.

Statistical processing of the research results was carried out by the use of Microsoft Excel 2010 and Statistica (version 5.0) for Windows software. Quantitative features were presented as mean ± standard error. The significance of difference between two independent groups was analyzed by the use of Mann-Whitney U-test, and between dependent samples of data – by the Wilcoxon T-test. The level of significance was p<0.05.

RESULTS

On the basis of clinical and ultrasound data, the following localization of thrombosis in varicose transformation of the tributaries of GSV was found (n=52):

- medial accessory branch of the GSV – 11 (21.2%);
- lateral accessory branch of the GSV – 5 (9.6%);
- external vena cava – 2 (3.8%);
- superficial superior mesenteric vein – 1 (1.9%);
- internal superficial femoral vein – 3 (5.8%);
- anterior popliteal tributary of the GSV – 2 (3.8%);
- posterior arch vein (Leonardo's vein) – 21 (40.4%);
- anterior arch vein of the lower leg – 7 (13.5%) patients (Fig. 1).

Ultrasonography revealed varicose transformation of GSV and failure of its valvular apparatus in 44 (84.6%) patients with tributary thrombophlebitis, and in 8 (15.4%) patients the superficial venous highway was intact. Among the examined patients, local varicose transformation with segmental valvular insufficiency of GSV was detected in 14 (31.8%), and diffuse varicose transformation with widespread valvular insufficiency – in 30 (68.2%) cases. In the presence of variceal ectasia

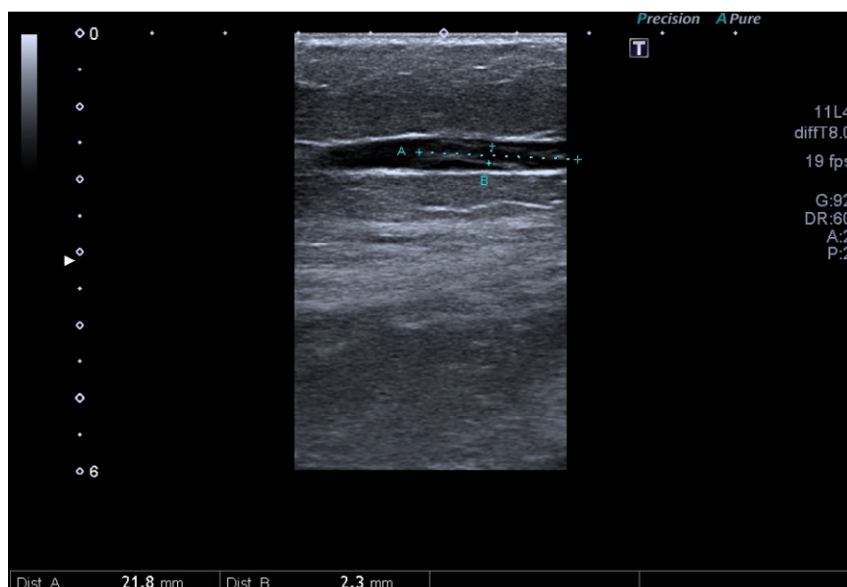


Fig. 2. Thrombotic occlusion of the medial accessory branch on the thigh.

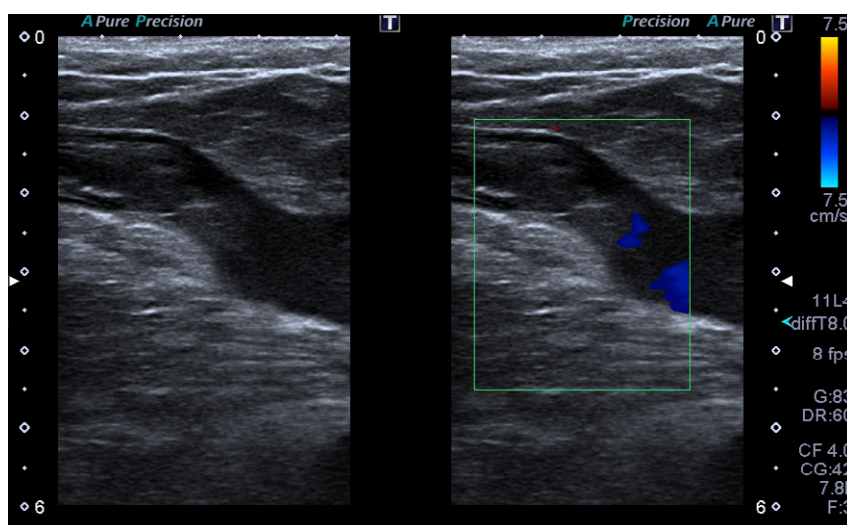


Fig. 3. Thrombosis of the saphenofemoral spigot.

of the trunk of GSV and failure of the valve apparatus of the latter, vertical reflux was diagnosed in all patients: local – in 14 (31.8%), widespread – in 14 (31.8%) and total – in 16 (36.4%) patients. The diameter of the trunk of GSV in the Valsalva test in inflow varicothrombophlebitis was on average 8.9 ± 0.27 mm and 11.2 ± 0.25 mm in horizontal and vertical provisions, respectively, being higher as compared to indicators in the control group: 3.8 ± 0.31 mm ($p < 0.05$) and 4.8 ± 0.27 mm ($p < 0.05$) in horizontal and vertical provisions, respectively (Table 1).

In case of thrombotic lesions of the varicose vein inflow, during the ultrasound examination, it is necessary to clearly define the boundaries of the thrombotic process (Fig. 2), to exclude or confirm the spread of thrombosis to the superficial venous main and/or deep venous system. Particular importance in assessing the spread of the thrombotic process was given to the examination of the saphenofemoral coexistence (Fig. 3) and the penetrating veins (Figs. 4, 5).

The ultrasound and clinical boundaries of the thrombotic process differed in all cases. In particular, during the ultrasound examination, the proximal and distal boundaries of superficial vein thrombosis exceeded the clinical ones by 15.26 ± 1.21 cm ($p < 0.05$) and 7.94 ± 1.32 cm ($p < 0.05$), respectively. Conducting control ultrasound examinations within the first week from the moment of diagnosis confirmation in patients with tributary thrombophlebitis who were prescribed anticoagulant therapy revealed a tendency to spread the thrombotic process in the proximal (in 12 (23.1%) cases) and distal (in 5 (9.6%) cases) directions. Particular importance during the ultrasound control study was given to the detection of the transition of the thrombotic process to the superficial venous highway. The spread of tributary thrombophlebitis to the superficial venous highway, despite anticoagulant therapy, was detected in 14 (26.9%) patients, among whom varicose transformation of the superficial high-

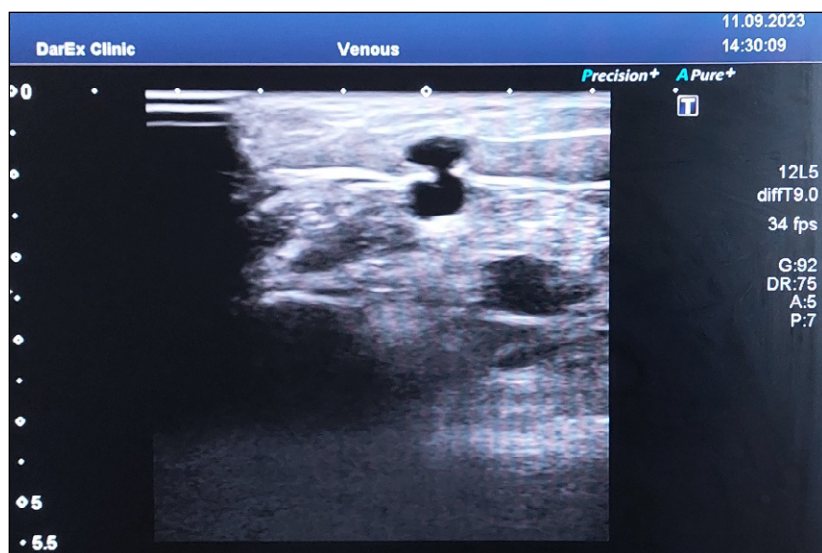


Fig. 4. Failed penetrating vein (cufflink symptom).

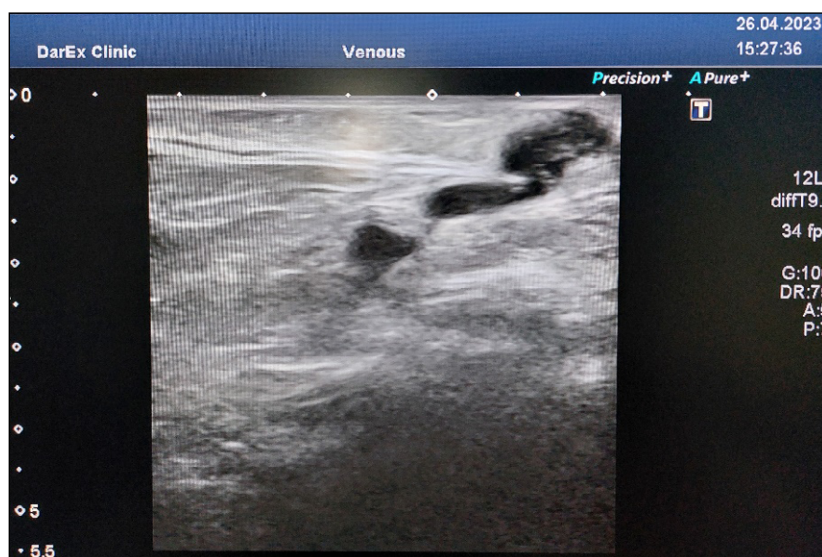


Fig. 5. Thrombotic occlusion of the failed penetrating vein.

way was detected in 9 (64.3%) patients. At the same time, in 12 (85.7%) of 14 patients with the spread of tributary thrombophlebitis to the superficial venous highway, the presence of an unfixed top of thrombotic masses was observed. Flotation of the thrombotic tip along with valve failure and venous reflux in the venous main line contributes to the progression of thrombosis, creates obstacles to the fixation of the thrombotic tip and its detachment with subsequent thromboembolism. The forces that contribute to the fragmentation of the floating tip are directed along the length of the thrombus and directly depend on the severity of venous reflux. Thrombus detachment is usually preceded by a sudden increase in venous pressure.

The incidence of venous thromboembolic complications also depends on the nature of the thrombotic masses and the duration of the pathological process. Ultrasound evaluation of the echostructure of throm-

botic masses allowed us to distinguish the following types of thrombi:

- «fresh» (disorganized) – in 15 (28.9%)
- partially organized – in 23 (44.2%);
- organized – in 14 (26.9%) patients.

Disorganized and partially organized thrombotic masses that were not fixed or only partially fixed to the venous wall were considered the most embolism-prone, with the duration of the pathological process in varicose veins not exceeding 7-10 days. This was evidenced by the progression of thrombotic lesions in 17 (44.7%) of 38 patients with disorganized thrombi.

Thus, the results obtained convincingly demonstrate the need for early ultrasound examination of patients with tributary thrombophlebitis, which allows to identify the real limits of the thrombotic process, timely diagnose the transition of the thrombotic process to superficial and deep venous lines, effectively predict the risk of venous thromboembolic complications and choose the optimal surgical tactics.

DISCUSSION

The German registry of treatment of patients with superficial vein thrombosis shows considerable variability in conservative methods of treatment of this pathology, with significant differences in treatment regimens, indications for anticoagulant prescription, and duration of administration [7]. At the same time, current recommendations for anticoagulant therapy are followed only in two-thirds of cases, and one-third of patients do not receive anticoagulants at all [7]. However, even with anticoagulant therapy, the percentage of deep vein thrombosis, pulmonary embolism, or their recurrence over the next 3 months does not decrease [7], which is confirmed by the results of early repeated ultrasound examinations [15]. A retrospective analysis of ultrasound examination methods of 11 739 patients revealed a recurrence of superficial vein thrombosis during the year in 27.2–31.4% of cases [16]. Multidisciplinary guidelines provide clear guidelines for ultrasound diagnosis of deep vein thrombosis, but do not determine the risk of venous thromboembolic complications in lower extremity superficial vein thrombosis [17]. However, 25% of patients with initial manifestations of superficial venous thrombosis, even without varicose ectasia, have asymptomatic pulmonary embolism [7].

A single-center retrospective study, which was based on ultrasound monitoring of 316 patients with superficial vein thrombosis, revealed that within 3 months from the onset of the disease, despite conservative treatment, thrombotic events occur in 29.2% of patients, in particular: in 19.2% of patients, progressive course of superficial vein thrombosis, in 9.8% – recurrence of superficial vein

thrombosis, in 5.7% – deep vein thrombosis occurs, and in 1.0% – pulmonary embolism was observed [18]. In this case, 82% of all venous thromboembolic events occurred in patients who received anticoagulant therapy from the moment of seeking medical help [18]. At the same time, in international and national recommendations, there are few indications regarding ultrasound imaging of superficial vein thrombosis [19].

The question of ultrasound assessment of the risk of venous thromboembolic complications in superficial thrombophlebitis remains open.

CONCLUSIONS

1. The ultrasound and clinical limits of the thrombotic process always differ, in particular, the proximal and distal limits of superficial vein thrombosis exceed the clinical ones by an average of 15.26 ± 1.21 cm ($p < 0.05$) and 7.94 ± 1.32 cm ($p < 0.05$), respectively.
2. During the first week from the moment of diagnosis confirmation, despite anticoagulant therapy, there was a tendency to spread the thrombotic process to the proximal and distal directions in 23.1% and 9.6% of patients, respectively.
3. The spread of tributary thrombophlebitis to the superficial venous highway, despite anticoagulant therapy, was detected in 26.9% of patients, of whom 64.3% had varicose transformation of the superficial highway and 85.7% of patients had an unfixed apex of thrombotic masses.
4. In all patients with progression of the thrombotic process, thrombotic masses were disorganized.

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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: 09.12.2023

ACCEPTED: 17.04.2024

