



## **STUDY OF HEMOCOAGULATION AND IMMUNE STATUS IN THE CENTRAL AND REGIONAL CIRCULATION IN PATIENTS WITH LOWER EXTREMITY VEIN THROMBOSIS.**

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<b>Article history:</b>	<b>Abstract:</b>
<b>Received:</b> March 10 <sup>th</sup> 2025 <b>Accepted:</b> April 10 <sup>th</sup> 2025	Coagulating and immunological status in the central and regional circulation in venous thrombosis of the lower extremities was studied. To determine the state of hemocoagulation and immune status in patients in the morning, blood was taken from the ulnar vein (common crib) and from the femoral vein in the area not affected by thrombosis (regional crib). The assessment of immune status included a study of the relative number of T lymphocytes and their subpopulations. Serum immunoglobulins class A, M, and G were tested

**Keywords:** Hemocoagulation

**INTRODUCTION.** Acute thrombosis of the major veins is a severe and often life-threatening condition. The number of such cases is not only failing to decline year by year, but there is also a clear trend toward an increase in their incidence [9, 5]. Post-thrombotic disease develops in 60–80% of patients after a certain period, and subsequently, 15–29% develop trophic ulcers of the lower leg [2, 4]. These complications frequently lead to prolonged disability or even permanent incapacity, particularly among young individuals of working age [1]. Given these consequences, the study and assessment of the hemostatic system in patients with lower extremity venous thrombosis remains highly relevant [6, 7, 8].

In recent years, an increasing number of studies have pointed to the role of autoimmune aggression in the process of venous thrombosis formation, contributing to the development and progression of venous insufficiency [3, 4]. In the early stages of the disease, only the venous wall exhibits antigenic properties, but as the pathological process progresses, the surrounding vascular tissues also acquire these characteristics. Investigating the interaction between the blood coagulation system and the immune system may help clarify their influence on the mechanisms of hemostasis and thrombosis. Correcting hemostasis and the immunological status in patients with lower extremity venous thrombosis may promote early recanalization and improve treatment outcomes.

**THE AIM OF THE WORK** is to study the coagulation and immune status in the central and regional blood flow in venous thrombosis of the lower extremities with

the aim of pathogenetic justified impact on hemocoagulation and immune status in the treatment of this category of patients.

**MATERIAL AND RESEARCH METHODS.** A total of 89 patients with venous thrombosis of the lower extremities were examined. Of these, 55 were diagnosed with acute deep vein thrombosis and 34 with superficial vein thrombosis. There were 32 men and 46 women. The immediate cause of the disease in 22% was inflammatory diseases and infection, surgical interventions and trauma - 19.5%, cardiovascular diseases - 17%, varicose veins - 14.5%. Other causes (oncological, intravenous infusions, hypothermia, physical overexertion) - 13%. In 15% of cases, the cause was not established. The study of this category of patients revealed that 21 (25%) were admitted in the first 3 days after the appearance of the first clinical signs of the disease, the main group of patients was admitted on the 4-8th day of the disease 63 (75%). This is due to the prodromal stage of the disease, when during the period of formation of the primary thrombus in the vein there are no pronounced hemodynamic disorders in the limb.

The circulatory system was examined using ultrasound Dopplerography. To determine the state of hemocoagulation and immune status in patients, blood was taken from the cubital vein (common vein) in the morning. In order to assess hemocoagulation and immunological status near the thrombosis site and in the perivascular tissue, blood was taken from the femoral vein in the area not affected by thrombosis (regional vein).



Assessment of the immune status included the evaluation of the relative number of T-lymphocytes and their subpopulations — theophylline-resistant (T-helpers) and theophylline-sensitive (T-suppressors) — which were determined using the method of spontaneous rosette formation. Serum immunoglobulin levels of classes A, M, and G were measured using the radial immunodiffusion method according to Mancini. A control group consisted of 24 practically healthy individuals.

In patients with deep vein thrombosis, significant alterations in hemostasis were observed, affecting both

central and regional blood flow. These changes were characterized by: Decreased blood clotting time, Reduced plasma recalcification time, Increased fibrinogen levels, Decreased fibrinolytic activity of the blood.

Importantly, fibrinolytic activity was further slowed in regional circulation, despite marked hypercoagulability. This was primarily attributed to the reduced levels of local fibrinolytic factors.

All these findings reflect significant shifts in the functional state of the coagulation and anticoagulation systems (see Table 1).

Table 1

Coagulogram indices in central and regional blood flow in patients with deep vein thrombosis (n-72)

Indicators	Norm (n-26)	Deep vein thrombosis	
		Central blood flow	Regional blood flow.
Blood clotting time (min)	4,2±0,5	4,0±0,3	3,7±0,3
PTI (%)	84±1,3	92±2,5	98±2,3
Plasma tolerance to heparin (min)	8,5±0,5	7,7±05	6,7±0,6
Plasma rec. time (sec)	110±5,2	123±4,1	129±3,3
Thrombotest (degree)	IV	IY-Y	Y-YI
Fibrinogen (g/l)	2,76±0,11	3,65±0,16	4,05±0,26
Fibrinolytic activity (min)	220±3,4	188±4,8	176±5,1

The study of patients revealed that blood clotting time was reduced in 70% of cases in both central and, to an even greater extent, regional circulation, compared to healthy individuals (4.2 ± 0.5 minutes). The average clotting times were 4.0 ± 0.5 minutes in central and 3.7 ± 0.3 minutes in regional blood flow, respectively. Plasma tolerance to heparin was decreased in 82% of patients in both circulatory zones. Compared to the control group (8.5 ± 0.5 minutes), the values were 7.7 ± 0.3 minutes in central (p > 0.05) and 6.1 ± 0.2 minutes in regional circulation (p < 0.05). Fibrinogen levels increased in 93% of patients, reaching 3.65 ± 0.16 g/L in central circulation and 4.68 ± 0.30 g/L in regional circulation, which was significantly higher than in healthy individuals (2.76 ± 0.11 g/L) (p < 0.05). Fibrinogen B was detected in 90% of patients in the central bloodstream and in 100% of patients in regional circulation. Despite pronounced hypercoagulability, the anticoagulation system was suppressed in 95% of patients.

This was evidenced by a reduction in fibrinolytic activity,

with average values of 188 ± 4.8 minutes in central circulation and 176 ± 5.5 minutes in regional circulation, compared to 220 ± 7.3 minutes in healthy individuals, which was statistically significant (p < 0.05).

Thus, the conducted studies revealed that in patients with acute deep vein thrombosis of the lower extremities, according to the coagulogram data in the central bloodstream, the above-mentioned indicators moderately deviated from the norm, while in the regional bloodstream, significant shifts towards hypercoagulation were noted.

A study of cellular immunity in patients with acute deep vein thrombophlebitis revealed that the relative percentage of T-lymphocytes in this group was 49.5 ± 1.1%, with an absolute count of 788 ± 46.5 cells/μL in central circulation, while in regional circulation the values were 46.7 ± 0.9% and 717.3 ± 43.5 cells/μL, respectively (P < 0.01). The relative proportion of theophylline-resistant T-lymphocytes (T-helper cells) in central circulation was



37.1 ± 0.8%, with an absolute count of 292.5 ± 25.7 cells/μL, and in regional circulation, 35.9 ± 0.7% and 257.5 ± 21.7 cells/μL, respectively. Compared to the control group of healthy individuals (39.1 ± 1.2% and 386.3 ± 31.5 cells/μL), these values were moderately reduced (P < 0.05). The number of theophylline-sensitive T-lymphocytes (T-suppressor cells) was significantly lower: in central blood flow — 12.4 ± 1.0% (absolute count: 97.8 ± 17.8 cells/μL), and in regional circulation — 10.2 ± 1.2% (absolute count: 73.1 ± 16.2

cells/μL), compared to the control group (18.3 ± 0.8% and 180.8 ± 16.5 cells/μL), showing a statistically significant decrease (P < 0.05).

Thus, in patients with acute deep vein thrombosis, the number of theophylline-sensitive T-lymphocytes was significantly decreased, while suppression of theophylline-resistant T-lymphocytes was less pronounced. These data are presented in Table 2.

*Table 2*

Indicators of cellular immunity in the central and peripheral blood flow in patients with acute deep vein thrombosis of the lower extremities (n=40)

Indicators		Almost healthy. faces (n-24)	Central blood flow	regional blood flow
T%-lymphocytes	Refers	57,6±1,5	49,5±1,1	46,7±0,9
	Absolute	988±39,4	788+46,5	717,3+43,5
Tf.res. lymphocytes	Refers	39,1±1,2	37,1±0,8	35,9±0,7
	Absolute	386,3±31,5	292,5+25,7	257,5+21,7
Tf.h. lymphocytes	Refers	18,3±0,8	12,4±1,0	10,2±1,2
	Absolute	180,8±16,5	97,8+17,8	73,1+16,2

The study of the humoral link of immunity showed an increase in the concentration of immunoglobulin class A in 55% of cases, where it was 3.02 · 0.2 g / l in the central bloodstream and 3.24 · 0.4 g / l in the regional one; in the control group it was 2.68 · 0.25 g / l (p > 0.05). At the same time, there was a pronounced increase in the concentration of immunoglobulin M in 85% of patients in the central bloodstream to 1.96 ·

0.32 g / l and in the regional one to 2.35 · 0.28 g / l compared to the control group - 1.32 · 0.3 g / l (p < 0.05). The concentration of immunoglobulins of class G increased in 60% of cases in the central bloodstream to 14.9 ± 0.4 g / l (p < 0.1) and in the regional to 16.7 ± 0.3 g / l (p < 0.001) compared to the control group of healthy individuals - 13.3 ± 0.5 g / l. The data are presented in Table No. 3

**Table 3**

Immunoglobulin levels in the general and regional blood flow in patients with acute deep vein thrombosis of the lower extremities (n=46)

Indicators (g/l)	Practical. healthy persons (n-24)	central blood flow	Regional blood flow



A	2,68±0,2	3,02±0,2	3,24±0,3
M	1,32±0,3	1,96±0,32	2,35±0,26
G	13,36±0,8	14,9±0,4	16,7±0,2

Thus, patients with acute thrombosis of the lower extremities had a disturbance in the immune status characterized by a decrease in cellular immunity, which is expressed in a decrease in the subpopulations of T-helpers and T-suppressors, and the humoral link of immunity was characterized by a moderate increase in all classes of immunoglobulins in the central bloodstream and more pronounced shifts in the regional bloodstream.

### CONCLUSIONS:

1. The conducted studies revealed that patients with acute thrombosis of the lower extremity veins exhibited increased coagulation activity and decreased anticoagulant function in the blood. Immunological disorders were characterized by a reduction in cellular immunity and an increase in humoral immunity, with the most prominent changes observed in regional blood flow.
2. In patients with acute lower limb thrombosis, the study of regional circulation makes it possible to determine the degree of process autonomy, which significantly influences the development and outcome of the pathological condition.
3. A comprehensive assessment of the body's reactivity is essential for a pathogenetically grounded approach to the treatment of this category of patients.

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