

Investigation of Venous Thromboembolic Complications in Patients Undergoing Endovascular Intervention

Said Madridovich Mirzakhanov^a, Khadija Muhammedovna Yunusova^a, Magomedsaid Magomedovich Abdulkhalikov^a, Zaira Sadrutdinovna Kulibekova^a, Zaira Abdulbasirovna Malakayeva^a, Asiyat Arslanovna Davdieva^a, Patimatulzakhra Arslanaliyeva^a, Azimkhanova^a, Timena Elbrusovna Abdullayeva^a, Uvaysova Madina Sapiyulayevna^a, Arslan Maridovich Mirzakhanov^b

Received: 13-April-2023

Revised: 08-May-2023

Accepted: 10-June-2023

^aFaculty of Medicine, Federal State Budgetary Educational Institution of Higher Education "Dagestan State Medical University" of the Ministry of Health of the Russian Federation

^b Department of Anesthesiology and Intensive Care, Russian National Research Medical University named after N. I. Pirogov

Abstract

Introduction: Venous thromboembolic complications (VTE) have been an important public health issue for many years. Venous thromboembolic complications include deep vein thrombosis of the lower extremities, saphenous vein thrombosis and pulmonary embolism. Endovascular surgeries are considered to be minimally traumatic, medium-long and complex surgical interventions, with catheterization or other intravascular manipulations. Therefore, deep vein thrombosis and pulmonary embolism are also possible after these surgeries. This potential risk is related both to possible stasis and endothelial damage during catheterization or other intravascular manipulations and to risk factors.

Objectives: Aim of the study: to study the incidence of VTE during endovascular interventions.

Methods: The research was conducted in the period from June to October 2022, 115 case histories of patients admitted to the Federal Center for Brain and Neurotechnology in Moscow were analysed during this period. Ultrasound duplex scanning was performed in all patients in the postoperative period.

Results: No clinical signs of lower limb venous thrombosis were found during postoperative period examination. Analysis of the results of ultrasound duplex scanning showed the presence of VTE in 5 patients (4.3±1.9%). One patient had echo-signs of thrombosis with recanalization, four patients had echo-signs of "fresh" thrombosis.

Conclusions: Screening ultrasound duplex scanning of lower limb vessels as the most objective method of VTE diagnosis should be performed in all patients without exception in the first day after the operation, since clinical signs of VTE may be absent or non-specific.

Keywords: endovascular surgery, deep vein thrombosis, venous thromboembolic complications, patient.

1. Introduction

Venous thromboembolic complications (VTE) are an important health problem and affect all specialties without exception. The significance of venous thromboembolic complications is associated with their high level of risk to the health and life of the patient. VTE in the postoperative period is one of the causes of complications and mortality of surgical patients. VTE includes deep vein thrombosis of the lower extremities, subcutaneous vein thrombosis and PE. Venous thrombosis is a condition that occurs when a vein is completely or partially closed by a blood clot, with subsequent possible embolic complications. Venous thromboembolic complications are most often manifested in the form of deep vein thrombosis (DVT). DVT is the formation of one or more blood clots within the deep veins (more often the veins of the lower extremities) [1], [2].

The mechanism of intravascular thrombosis is associated with hypercoagulation, endothelial damage and slowing of blood flow. Stasis and damage to the endothelium can occur during catheterization or other intravascular manipulations, especially with endovascular interventions, with various surgical operations, significant injuries and fractures, immobilization of the limb or forced body position, anesthesia (more than 60 minutes) using muscle relaxants. Risk factors also include the presence of thrombophilia, age 40 and over, smoking, dehydration of the body, a history of DVT, a burdened history (DVT in relatives), medical conditions (neoplasms, acute myocardial infarction, heart failure, stroke, obesity, and others) [3], [4].

About 1.5 cases of DVT of the lower extremities per 1000 adults are detected every year. The frequency of PE is up to 60 cases per 100,000 population. Age over 40 years increases the incidence of DVT to 200 cases per 1000 population per year. Pulmonary embolism accounts for about 35-40 cases per 100,000 people annually. A quarter of cases of venous thromboembolic complications are due to various surgical interventions [5].

Venous thrombosis is often asymptomatic. Such an asymptomatic condition is usually characteristic of patients who are on bed rest. Often, the first sign of thrombosis may be the pulmonary embolism itself. Therefore, it is necessary to conduct instrumental studies, since the clinical signs of deep vein thrombosis are nonspecific. Instrumental examination is extremely necessary for patients who have edema, pain and cyanosis of the skin of the lower extremities to exclude possible deep vein thrombosis. If DVT is suspected, a first-order instrumental method is used for the ultrasound of the veins of the lower extremities. With normal results, it is recommended to repeat the study after 6-7 days. The sensitivity of ultrasound Dopplerography reaches 95%, and the specificity is 98%. It is also recommended to determine the level of D-dimer in the blood to exclude deep vein thrombosis. The D-dimer test has a sensitivity of 90%, and the specificity is only 79% [6], [7].

During a general examination with deep vein thrombosis, the following symptoms are revealed: swelling of the ankle or lower leg, swelling of the entire leg with a possible spread of edema even to the abdominal wall; palpatory soreness in the projection of the affected vascular bundle of the lower limb; positive symptoms of Homans, Moses, Lovenberg. The use of these tests is limited due to their low diagnostic significance and the risk of developing PE. It is also necessary to determine the presence of cyanosis of the skin of the lower extremities, dilated subcutaneous veins on the lower leg, arterial pulsation at all levels, skin temperature on both lower extremities, sensitivity, volume of active and passive movements in the joints [8], [9].

In surgical patients, the risk of venous thrombosis depends on many factors: the patient's somatic status at the time of surgery, concomitant pathologies, duration of anesthesia, dehydration, duration of immobilization. The most important factors are the type of surgical intervention, its traumaticity and duration [10].

Endovascular operations are low-traumatic, medium-long and complex types of surgery, with catheterization or other intravascular manipulations. Therefore, DVT and PE after these operations is also possible. Every year, the volume and number of endovascular operations increases. A potentially high risk of thromboembolic complications in patients with endovascular intervention is associated with both possible stasis and damage to the endothelium during catheterization or other intravascular manipulations, and with probable risk factors for VTEO, which include probable paresis and plegia of the limb, low motor activity, immobility [11].

2. Objectives

The purpose of this work is to study the frequency of VTE in patients undergoing endovascular intervention and to identify risk factors contributing to the occurrence of thromboembolic malting in this group of patients.

2. Methods

The study was conducted in the period from June to October 2022, during this period 115 case histories of patients admitted to the Federal Center for Brain and Neurotechnology in Moscow were analyzed. The main pathologies encountered in these patients were aneurysms of various parts of the middle cerebral artery, posterior cerebral artery; dural arteriovenous fistulas; aneurysms of various segments of the internal carotid artery; atherosclerosis of the intracranial arteries; arteriovenous malformations and others. Surgical tactics – endovascular intervention with embolization of aneurysm, fistula, arteriovenous malformation or stenting in atherosclerosis.

Ultrasound duplex scanning was performed in all patients in the postoperative period. The initial condition of 96 patients was satisfactory, 19 patients were in a state of moderate severity. Among the analyzed patients, the female sex was 70 (60.9%), the average age was 52.3 ± 7.8 years, the male sex was 45 (39.1%), the average age was 50.1 ± 8.2 years. Among 115 patients, 1 subject had chronic venous insufficiency (a history of deep vein

thrombosis of the lower extremities), 25 had varicose veins of the lower extremities, peripheral edema was absent in all subjects, consciousness in the preoperative period was clear for all. Concomitant diseases were observed in 102 patients. 96 patients had concomitant bleaching of 2 or more. Hypertension of varying degrees was observed in 67 patients. 12 patients had chronic kidney disease. 16 patients had type 2 diabetes mellitus. 60 patients were overweight. 11 had hyperthyroidism, 14 subjects had hypothyroidism as a concomitant disease, 6 had the presence of malignant neoplasms. One patient had an ischemic stroke with neurological disorders in the form of right-sided hemiparesis and motor aphasia. A third of patients had a history of using ACE inhibitors. As a comparative group, data from the article "The frequency and nature of thromboembolic complications in patients with fractures of the bones of the lower extremities" were used. The article noted that out of 311 patients, VTEO of the venous bed was detected in 44 patients (14%) [12].

3. Results

During the examination in the postoperative period, clinical signs of deep vein thrombosis of the lower extremities were not found. The skin temperatures of the lower extremities are normal in all the subjects. The presence of preserved arterial pulsation at all levels was noted in all patients.

Analysis of the results of ultrasound duplex scanning showed the presence of VTE in 5 patients $4.3 \pm 1.9\%$. One patient had echographic signs of thrombosis of the trunk of the small subcutaneous vein bilaterally at the stage of initial recanalization (the presence of deep vein thrombosis of the lower extremity, chronic venous insufficiency of the 3rd degree, the presence of dilated varicose veins of the lower extremities is noted in the anamnesis). Echo signs of occlusive thrombosis of the small subcutaneous vein of the right tibia, sural veins of the left tibia, without flotation were found in two patients. Another patient had echographic signs of thrombosis of the trunk of the small subcutaneous vein bilaterally. Also, another patient had echographic signs of thrombosis of the tibial veins of the left limb, without flotation. In 110 patients, the conclusion of vascular ultrasound indicated the absence of echographic signs of patency of the examined veins of the lower extremities (Table 1).

Table 1 - USDG results in patients with various risk factors for DVT

	Echo signs unchanged	Echo signs of thrombosis with recanalization	Echo signs of "fresh" thrombosis
Total number of patients (115)	110	1	4
Patients over 40 years of age (98)	93	1	4
History of DVT (1)	0	1	0
The presence of motor disorders (plegias, paresis) (1)	1	0	0
Oncological disease, chemotherapy (6)	5	0	1
BMI>28-60	56	0	4
Varicose veins (25)	22	1	2
Type 2 diabetes mellitus (16)	14	1	1
Chronic kidney disease (12)	11	0	1
Anesthesia for more than 1.5 hours (66)	62	1	3
Anesthesia less than 1.5 hours (49)	48	0	1
2 or more comorbidities (96)	91	1	4

The condition is of moderate severity, stable. There were no signs of violations of vital functions. Normothermy. There were no complications from organ systems. On the part of the cardiovascular system, there were no risks of venous thromboembolic complications in the early postoperative period. Hemodynamics

remained stable without vasopressor and inotropic support, heart tones were clear, rhythmic, there were no noises, there was a sinus rhythm on the ECG. Respiratory system: auscultation breathing was carried out in all departments, wheezing was not noted, 43 patients had severe breathing. The digestive system of all the subjects functioned normally: the abdomen remained soft, painless, peristaltic noises were auscultatively listened to, peritoneal symptoms were not determined. The urination system functioned normally, including the subjects with CKD. Urination by urethral catheter, urine is light yellow, the rate of diuresis is adequate to volemic load, without pathological impurities. The catheter was removed during transfer to the specialized department, dysuria was not noted.

The prognostic scale SOFA 1 in all the subjects. Status localis: there are no signs of hematoma in the area of the inguinal folds, from where endovascular access was carried out. The limb from which the access was carried out is warm, pink, pulsation in the peripheral arteries is preserved. Venous access: the peripheral venous catheter is

functioning, there are no signs of hematoma and signs of inflammation in the standing area, the aseptic sticker is clean. Neurological status: conscious, in contact, comprehensively oriented, critical, no meningeal symptoms were detected, movements in the limbs were preserved (1 patient had right-sided hemiparesis, after an ischemic stroke). The average duration of anesthesia in the studied patients was 1 hour 59 minutes \pm 19 minutes. The average duration of the operation was 1 hour 45 minutes \pm 8 minutes.

The obtained data of our own study were compared with the results of a literary study, in which it was noted that out of 311 patients with fractures of the bones of the lower extremities in the department of traumatology, VTE venous bed was detected in 44 patients (14%) [12]. The frequency of venous thromboembolic complications after endovascular interventions in our study was $4.3 \pm 1.9\%$, out of 115 patients, VTEO was detected in 5 patients. $p=0.00014472$. The value $P<0.05$ was taken as the level of statistical significance of the differences. Based on the data obtained on the level of statistical significance of the differences between the study group and the comparative literature group, it can be confirmed that there is a relationship between injury and the frequency of VTEO.

4. Discussion

1. The frequency of venous thromboembolic complications after endovascular interventions was $4.3 \pm 1.9\%$, out of 115 patients, 5 patients had VTEO.
2. Screening ultrasound duplex scanning of the vessels of the lower extremities as the most objective way to diagnose VTEO should be performed in all patients during the first day after surgery, since clinical signs may be absent or non-specific.
3. Risk factors that increase the likelihood of VTEO are: age over 65 years, hypertension II degree, cardiovascular risk is very high, chronic kidney disease stage 2, body mass index $>28\text{kg/m}^2$, duration of anesthesia more than 1.5 hours, cancer, chemotherapy, a history of DVT, varicose veins of the n/extremities, etc.

References

1. G.G. Khubulava, E.K. Gavrillov, H.L. Bolotokov, etc. Bulletin of Surgery named after I.I. Grekov. 2019. **178**:77. DOI: 10.24884/0042-4625-2019-178-1-77-81.
2. Warren JA, Sundaram K, Kamath AF, Molloy RM, Krebs VE, Mont MA, Piuizzi NS., Venous Thromboembolism Rates Did Not Decrease in Lower Extremity Revision Total Joint Arthroplasty From 2008 to 2016, J Arthroplasty. 2019, **34(11)**:2774 doi: 10.1016/j.arth.2019.05.012
3. Joseph W Greene, Ajit J Deshmukh, Fred D Cushner, Thromboembolic complications in arthroscopic surgery, Sports Med Arthrosc Rev 2013; **21(2)**:69. doi: 10.1097/JSA.0b013e31828a7e76.
4. Bonno van Bellen, Ivan de Barros Godoy, Andrea Almeida Reis, Pedro Bertevello, Venous insufficiency and thromboembolic disease in bariatric surgery patients, Arq Gastroenterol, 2013; **50(3)**:191. doi: 10.1590/S0004-28032013000200034.

5. Mei M Chan, Numan Hamza, Basil J Ammori, Duration of surgery independently influences risk of venous thromboembolism after laparoscopic bariatric surgery, *Surg Obes Relat Dis*, 2013; **9(1)**:88-93. doi: 10.1016/j.soard.2011.09.019
6. Malcolm Nicol, Yu Sun, Niall Craig, Douglas Wardlaw, Incidence of thromboembolic complications in lumbar spinal surgery in 1,111 patients, *Eur Spine J*, 2009 ;**18(10)**:1548. doi: 10.1007/s00586-009-1035-4
7. Konstantinides SV, Meyer G, Becattini C. Oxford: *European Heart Journal* 2014. 3:48. doi: 10.1093/eurheartj/ehu283.
8. Nancy E Epstein, A review of the risks and benefits of differing prophylaxis regimens for the treatment of deep venous thrombosis and pulmonary embolism in neurosurgery, *Surg Neurol* 2005; **64(4)**:295;. doi: 10.1016/j.surneu.2005.04.039
9. American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest Am Coll Chest Phys*. 2012. **141**:2. DOI: 10.1378/chest.11-2304.
10. Mario Ganau, Lara Prisco, Helene Cebula, Julien Todeschi, Housseem Abid, Gianfranco Ligarotti, Raoul Pop, Francois Proust, Salvatore Chibbaro, Risk of Deep vein thrombosis in neurosurgery: State of the art on prophylaxis protocols and best clinical practices, *J Clin Neurosci*, 2017; **45**:60. doi: 10.1016/j.jocn.2017.08.008.
11. Russian clinical guidelines for the prevention and treatment of venous thromboembolic complications in cancer patients. Moscow: Planida, Moscow 2012. page 32.
12. V.G. Fedorov, I.V. Kuzin, O.N. Shapranov. *Modern problems of science and education*. 2020. **4**:1 DOI: 10.17513/spno.30000