

Research Article

Early and Remote Results of Surgical Treatment of Inferior Vena Cava Thrombosis

Yaroslav Popovych

Abstract

The objective of the research was to estimate the early and remote results of surgical treatment in patients with deep vein thrombosis of the inferior vena cava.

Material and methods. The results of treating 790 patients with lower limb deep vein thrombosis and thrombosis of the inferior vena cava were analyzed. Depending on treatment, all the patients were divided into the following groups: Group IA consisted of 380 (68.5%) patients with deep vein thrombosis who underwent open complete or partial thrombectomy with or without surgical prevention of pulmonary thromboembolism; Group IB consisted of 50 (9.0%) patients with deep vein thrombosis who received combined treatment with surgical prevention of pulmonary thromboembolism; Group IC consisted of 125 (22.5%) patients with transfascial thrombosis who underwent thrombectomy of the apical thrombotic masses of deep veins followed by radical venectomy; Group II consisted of 235 (29.7%) patients with deep vein thrombosis who received conservative anticoagulant therapy only.

For investigation of patients, there were used the following laboratory methods of examination: duplex ultrasound scanning, X-ray phlebography, computer tomography, echocardiography and radionuclide phleboscintigraphy.

Results. The results of surgical and combined methods of treating deep vein thrombosis in clinical subgroups were evaluated using a three-point scale - good, satisfactory and unsatisfactory. The cumulative analysis of the results of the postoperative period during 3 years of follow-up showed that good and satisfactory results were observed in 89.3% of patients of Group IA, 81.7% of patients of Group IB, 88.4% of patients of Group IC, and 35.3% of patients of Group II. Three years after treatment, the signs of chronic venous insufficiency were found in 51.6% of patients who underwent conservative treatment, 36.4% of patients who received combined treatment, 10.2% of patients who underwent partial thrombectomy, 2.9% of patients who received surgical treatment of transfascial thrombosis; they were absent in patients who underwent radical thrombectomy.

Conclusions. In quantitative evaluation of the early and remote results of treating deep vein thrombosis of the inferior vena cava, a significant improvement in the patients' condition in all parameters was observed in the main group as compared to the control one.

Keywords

deep vein thrombosis; inferior vena cava; thrombectomy; conservative treatment; postoperative period

Department of Surgical Diseases, Medical Faculty, Uzhhorod National University, Uzhhorod, Ukraine

Corresponding author: angiosurgery@i.ua

Problem statement and analysis of the recent research

In the United States and European Union, deep vein thrombosis (DVT) of the inferior vena cava (IVC) has rates of 150-300 cases per 100, 000 population per year [1, 7, 11, 14]. Thus, according to various data, 2 to 20 million cases of DVT are registered annually in the USA [7, 12]; in 600-700 thousand of cases, pulmonary embolism (PE) [5, 12] occurs accounting for 26-28% of all cases [7].

Three-five years after conservative treatment, the consequences of DVT are registered in 25-87% of patients who had extensive tibial vein thrombosis, 46% of patients who had tibial and femoral vein thrombosis and 90-98% of patients after iliofemoral phlebothrombosis [3, 16]. Five-ten years after treatment, the symptoms of post-thrombotic syndrome (PTS) are observed in 49-100% of patients [3, 18, 19], while

post-thrombotic changes in deep veins of both lower extremities are detected in 7.4-34.1% of patients, and inferior vena cava syndrome (IVCS) - in 12.3% of patients [10].

Even the results of conservative treatment of DVT do not convince authors of the ineffectiveness of anticoagulant therapy - 5 years after treatment, 95% of patients are diagnosed with venous hypertension, 90% of patients develop pronounced venous reflux, 50% of patients suffer from the dysfunction of veno-muscular pump of the tibia, in 15% of patients, trophic ulcers are found, and in 15-50% of patients - intermittent venous claudication [15, 17]. B. Geier and co-authors (2009) provide data on the preservation of permeability of recanalized thrombosed veins 5 years after open thrombectomy in 75% of patients, and the presence of signs of PTS in 20% of cases only [13].

Despite the constant increase in PE incidence, the frequency of surgical treatment of DVT remains low. Venous

thrombectomy are performed in 20-25% of cases only [6, 8], which, according to I.M. Hudz (2006), is mainly due to the doctor's qualification and traditions of the clinic [2].

In developed countries, among chronic veins diseases, PTS accounts for 28% of all cases. It is diagnosed in 2-7% of people of working age [9], 10% of whom have the signs of disability [10]. Despite modern conservative treatment of DVT, there is a clear tendency towards the increase in the incidence of PTS. It occurs in 20-52.8% of patients who had DVT [4, 7]. Trophic changes in the skin occur 4-6 years after DVT [10].

Thus, even modern anticoagulant therapy for DVT does not allow preventing the development of PTS in the remote period and the results of treatment remain unsatisfactory. PT is still considered to be one of the main causes of lethality and the number of patients with severe forms of chronic venous insufficiency (CVI) is steadily increasing.

The objective of the research was to estimate the early and remote results of surgical treatment in patients with DVT of the IVC.

1. Material and methods

The results of treating 790 patients with lower limb DVT and thrombosis of the IVC who were treated in the department of Surgery and Urology of the Transcarpathian Regional Clinical Hospital named after A. Novak during 2006-2016 were analyzed. The patients' age varied from 17 to 83 years; the average age was 46 ± 2.3 years. Among them, there were 334 (42.3%) men and 456 (57.7%) women. The majority of patients was of working age - 735 (93.0%) people. At the same time, about half of all examined and treated patients were young and of middle age (under the age of 40 years) - 395 (50%) individuals.

Depending on treatment, all the patients were divided into the following groups:

- Group I (the main group) consisted of 555 (70.3%) patients who underwent surgical treatment of DVT and PE prophylaxis with subsequent conservative treatment, in particular:
 - Group IA consisted of 380 (68.5%) patients with DVT who underwent open complete or partial thrombectomy with or without surgical prevention of PE;
 - Group IB consisted of 50 (9.0%) patients with DVT who received combined treatment with surgical prevention of PE;
 - Group IC consisted of 125 (22.5%) patients with transfacial thrombosis who underwent thrombectomy of the apical thrombotic masses of deep veins followed by radical venectomy.
- Group II (the control group) consisted of 235 (29.7%) patients with DVT who received conservative anticoagulant therapy only.

All the patients were prescribed anticoagulant, infusion and antispasmodic, compression therapy, regardless of the need for surgical treatment.

For investigation of patients, there were used the following laboratory and instrumental methods of examination: duplex ultrasound scanning ("ULTIMA PRO-30, z.one Ultra", Zonare Medical Systems Inc., USA), X-ray phlebography (DSA, Integris-2000, Philips), computer tomography (Somatom CRX, Siemens, Germany, 1994), echocardiography. Radionuclide phleboscintigraphy was performed (the emission computed tomography scanner "Tamara", Ukraine) as well. There were determined the average transit time (ATT) of the isotope and the load index (LI).

Considerable attention was given to the determination of the type of thrombotic lesions and the nature of thrombotic masses. Thus, in most patients of the main group (408 (73.5%) individuals), occlusive thrombotic lesions were found; in 129 (23.2%) patients, mural thrombotic lesions were observed; in 18 (3.3%) patients, fragmentary thrombotic lesions were detected. In 403 (72.6%) patients of the main group, the proximal part of thrombotic masses had a floating nature. Among the patients of the control group, occlusive thrombotic lesions were found in 162 (68.9%) patients, mural thrombotic lesions were seen in 73 (31.1%) patients; the floating apex of thrombotic masses was observed in 34 (14.5%) cases. Patients with fragmentary thrombotic lesions were not included in the control group.

By the nature of thrombotic masses, there were distinguished loose, well-formed and tumor thrombi. Loose thrombotic masses were detected in 417 (52.8%) patients, well-formed thrombotic masses were observed in 344 (43.5%) patients, tumor thrombotic masses were found in 29 (3.7%) patients. In patients of the main group, loose thrombotic masses were detected in 380 (68.5%) cases, well-formed thrombotic masses were observed in 146 (26.3%) cases and tumor thrombotic masses were found in 29 (5.2%) cases. In the control group, well-formed thrombotic masses were found in 198 (84.3%) patients, loose thrombotic masses were detected in 37 (15.7%) patients. Patients with tumor thrombosis were not included in the control group as they do not respond to anticoagulation therapy.

Surgical interventions aimed at DVT treatment and PE prevention are presented in Table 1, 2, 3.

2. Results and discussion

The results of surgical and combined methods of treating DVT in clinical subgroups were evaluated using a three-point scale - good, satisfactory and unsatisfactory.

The criteria for good results after surgical and combined treatment of DVT were considered the intraoperative restoration of occluded arterial inflow and outflow, venous collector, confirmed by ultrasound; increase in linear (LFR) and volumetric (VFR) blood flow rate (VFR) above the site of occlusion by more than 50% during ultrasound; complete restoration of the function the affected limb; the absence of

Table 1. Surgical intervention for DVT in patients of Group IA

| Type of surgical intervention | Number |
|---|-------------------|
| Thrombectomy from the PV and calf sinuses, ligation of calf sinuses at the site of entry into the PV | 70 (18.4%) |
| Thrombectomy from the PV, ligation of thrombosed trunks of the tibial veins at the site of entry into the PV | 35 (9.2%) |
| Thrombectomy from the SFV, ligation of the SFV below the DFV | 67 (17.6%) |
| Thrombectomy from the CFV, ligation of the SFV below the DFV | 55 (14.5%) |
| Thrombectomy from the CFV, ligation of the DFV at the site of entry into the CFV | 21 (5.5%) |
| Thrombectomy from the CFV and the EIV, ligation of the SFV below the DFV | 58 (15.3%) |
| Thrombectomy from the CFV and the EIV, ligation of the CFV below the GSV | 3 (0.8%) |
| Thrombectomy from the CFV and the EIV with the formation of distal AV fistula | 13 (3.4%) |
| Thrombectomy from the EIV and the CIV, ligation of the EIV below the IIV | 7 (1.8%) |
| Thrombectomy from the infra- and/or intrarenal portions of the IVC | 11 (2.9%) |
| Thrombectomy from the infra- and/or intrarenal portions of the IVC + surgical caval plication of the IVC | 5 (1.3%) |
| Thrombectomy from the suprarenal portion of the IVC | 9 (2.4%) |
| Thrombectomy from the suprarenal portion of the IVC + caval plication of the IVC | 12 (3.2%) |
| Thrombectomy from the subdiaphragmatic portion of the IVC and the right auricle | 1 (0.3%) |
| Thrombectomy from the subdiaphragmatic portion of the IVC and the right auricle + surgical caval plication of the IVC | 13 (3.4%) |
| Total | 380 (100%) |

Notes: PV – popliteal vein, DFV – deep femoral vein, SFV- superficial femoral vein, CFV – common femoral vein, EIV– external illiac vein, IIV – internal illiac vein, CIV – common illiac vein, GSV - great saphenous vein, AV fistula - arteriovenous fistula.

Table 2. Combined treatment of patients in Group IB

| Combined treatment | | Apex of thrombotic masses | | | | | | | | Total |
|-------------------------------|-------------------------------|---------------------------|---|------------------|---|---------------|----|--------------|----|-------|
| | | Calf veins | | Popoliteal veins | | Femoral veins | | Illiac veins | | |
| Regional thrombolytic therapy | Vena cava filter implantation | 3 | | 2 | | 7 | | 19 | | 31 |
| | Surgical thrombectomy | | 7 | | 5 | | 19 | | 19 | 50 |
| | | 4 | | 3 | | 12 | | - | | 19 |

Table 3. Surgical interventions in Group IC

| Surgical intervention | Number |
|--|-------------------|
| Partially open CFV thrombectomy, crossectomy, phlebectomy | 54 (43.2%) |
| Open CFV thrombectomy (CFV venectomy), crossectomy, phlebectomy | 8 (6.4%) |
| Partially open PV thrombectomy, crossectomy, phlebectomy of the SSV and /or the GSV | 15 (12.0%) |
| Open PV thrombectomy (PV venectomy), crossectomy, phlebectomy of the SSV and the GSV | 5 (4.0%) |
| Open PV and/or calf sinuses thrombectomy (PV venectomy), crossectomy, phlebectomy of the SSV and the GSV, ligation of the thrombus in calf sinuses | 26 (20.8%) |
| Ligation of the SFV below the DFV, crossectomy, phlebectomy | 3 (2.4%) |
| Crossectomy, phlebectomy of the GSV, ligation of the PV below the SSV | 7 (5.6%) |
| Open venae perforantes thrombectomy, crossectomy, phlebectomy | 7 (5.6%) |
| Total | 125 (100%) |

Notes: SSV – small saphenous vein.

”bursting” pain in the affected lower limb; the reduction in limb edema by not less than 50% as compared to preoperative indices and its complete disappearance after a night’s sleep; the absence of DVT/PE relapses and trophic changes.

The results were considered satisfactory in case of the intraoperative restoration of the occluded venous trunk and venous collector, confirmed by ultrasound; the increase in LFR and VFR within 30-50% during ultrasound; moderate

limitation in the function of the affected limb; considerable reduction in feeling of "bursting" pain in the affected lower limb; the reduction in limb edema within 50% in comparison with preoperative indices; the absence of DVT/PE recurrence; the presence of hyperpigmentation and skin induration.

The results were considered unsatisfactory in case of rethrombosis of the occluded venous trunk and venous collector confirmed by ultrasound; the decrease in LFR and VFR as compared to preoperative indices during ultrasound; significant impairment of the function of the affected limb; the preservation or progression of feeling of "bursting" pain in the affected lower limb; the increase in or the presence of limb edema, especially in the evening, and the absence of reduction in limb edema after a night's sleep; the presence of DVT/PE recurrence; expressed signs of trophic changes in the skin of the shin of the affected limb in the form of trophic ulcers.

In case of graduated exercise, the dynamics of venous outflow before and after treatment and in the long-term period (up to 3 years) showed the effectiveness of surgical intervention, both radical and palliative one. The reduction in the obstruction of large venous collectors in partial thrombectomy leads to the significant increase in volumetric blood flow, and complete thrombectomy restores it to normal. Thus, the ATT in the veno-muscular pump of the tibia decreased from 21-36 sec to 7-12 sec (complete thrombectomy) and to 11-18 sec in partial thrombectomy. LFR increased from 2-5 cm/sec to 9-18 cm/sec and to 4-9 cm/sec, respectively. The LI increased from 1-1.2 to 2.8-3.4 and to 2.2-2.8, respectively.

At the same time, in the group of patients who received conservative therapy only, the ATT after treatment was 18-26 sec, LFR - 2-6 cm/sec, the LI - 1-1.3. The results of blood flow restoration after combined treatment are the following: the ATT - 9-14 sec, the LI - 2.3-3.0 and LFR - 7-11 cm/sec. The average indices of the ATT, the LI and LFR before and after treatment were used for statistical processing.

The data obtained when studying blood flow were consistent with the clinical results that considered the prevalence of CVI signs in patients of both groups in the long-term period after DVT. The complaints were reported in 51.6% of patients who underwent conservative treatment, 36.4% of patients who received combined treatment, 10.2% of patients who underwent partial thrombectomy, 2.9% of patients who received surgical treatment of transfascial thrombosis; they were absent in patients who underwent radical thrombectomy. Thus, the functional results of surgical treatment exceeded the results of the conservative one.

Prior to the discharge from the hospital, in 84 (21.1%) out of 380 patients of Group IA, the results of surgical treatment of DVT of the IVC were evaluated as good; in 292 (76.8%) patients, they were evaluated as satisfactory and only in 4 (1.1%) patients, the results of surgical treatment were unsatisfactory. The complications were observed in 38 (10%) patients.

The most frequent complication was lymphorrhea, which was observed in 21 (4.7%) of 380 patients. The average duration of lymphorrhea was 12 ± 1.4 days (11 to 22 days). To

eliminate lymphorrhea, phlebotrophic drugs, tight bandaging of the postoperative wound zone, and, if necessary, ultrasound-guided seroma drainage were used.

Marginal necrosis of the postoperative wound was observed in 6 (1.4%) of 380 patients, in particular at the femoral and popliteal access sites - in 4 and 2 patients, respectively. The effects of necrotic changes in all patients were eliminated using local therapy and the postoperative wounds at the site of marginal necrosis healed by secondary intention.

The suppuration of the postoperative wound was observed in 4 (0.9%) out of 380 patients. The suppuration of the postoperative wound in the inguinal region was observed in 2 patients; the suppuration of the postoperative wound in the popliteal region was found in 1 patient; the suppuration of the postoperative wound after laparotomy was seen in 1 patient. In all the patients, inflammatory complications were superficial and did not spread below the superficial fascia. The manifestations of purulent inflammation were eliminated within 2 weeks after the administration of local antibiotic therapy and drainage in addition to systemic therapy. The postoperative wounds healed by secondary intention.

In 1 (0.2%) out of 380 patients, there was observed bleeding from the postoperative wound in the inguinal region. The latter was due to diffuse bleeding from the subcutaneous cellular tissue on the background of anticoagulant therapy that required repeated surgical intervention with thorough haemostasis.

In 4 (0.9%) out of 380 patients, the spread of the thrombotic process beyond the surgical site was observed - 2 patients with open CFV thrombectomy and ligation of the SFV below the DFV and 2 patients after open PV thrombectomy and ligation of calf sinuses. The extension of thrombotic lesions in the proximal direction in the postoperative period was observed in adequate anticoagulant therapy. In 2 patients, during the examination, the signs of hereditary thrombophilia were detected; 1 patient was diagnosed with oncological pathology; in one patient, the cause of rethrombosis was not found. All patients with thrombosis relapse underwent conservative anticoagulant therapy which allowed to prevent PE in all the patients.

After surgical caval plication of the IVC, none of 30 patients had signs of PE before their discharge from the hospital.

In 2 (3.9%) out of 51 patients, up to 5 days after laparotomy for the thrombotic occlusion of the IVC, there was observed the phenomenon of intestinal paresis which was eliminated using conservative agents.

The length of patients' stay in the hospital after open thrombectomy ranged from 10 to 23 days, on average 14 ± 2.3 days. There were no lethal cases as well as cases of PE.

There were studied the results of surgery for DVT and PE prevention in 246 patients of Group IA in the early postoperative period during the 1st year of follow-up. In 134 (54.5%) out of 246 patients, the results of surgical treatment were evaluated as good; in 107 (43.5%) patients, they were evaluated as satisfactory and only in 5 (2.0%) patients, the results of

surgical treatment were unsatisfactory.

In 217 patients after partial thrombectomy for deep veins of the lower extremities in the period from 2 to 4 months, ligature resorption was observed. The ligation was applied with the aim of preventing PE, with the restoration of the permeability of the venous trunk. By the time of ligature resorption in the distal regions, subtotal recanalization (to 60-80%) was usually observed.

The complications in the early postoperative period were detected in 6 (2.4%) out of 246 patients of Group IA. In 5 patients, the recurrence of DVT with the extension of the process in the proximal direction was observed. In 2 patients, the relapse was caused by oncologic pathology, in 2 patients, it was due to diabetes mellitus. In one patient, the cause of DVT recurrence was not detected. All the patients were prescribed anticoagulant therapy. In cases of oncological disease, lifelong anticoagulation was recommended.

In one patient, after surgical caval plication, embolism at the site of plication was observed. At the same time, the thrombotic lesion did not spread beyond the zone of caval plication and no signs of PE were observed. Anticoagulant therapy for this patient was extended to 12 months.

In all the patients who underwent the placement of AV fistula after thrombectomy from the femoral-iliac segment, the fistulas were closed independently within 3-10 weeks. There were observed no signs of thrombosis relapse, purulent-septic complications and general complications. PTFE coated ligature was removed after ultrasound confirmation of closure of the AV fistula.

According to instrumental study, if the diameter of fistula was up to 4 mm, there were no signs of the right heart overload and "stealing" blood from the peripheral arterial bed.

There were observed 30 patients after surgical caval plication in the early postoperative period. In dynamic control, it was found that in 27 (90%) of 30 patients 10 to 12 months after operation, the clips on the IVC became visible with gradually restoration of its lumen. In 3 patients, the lumen of the IVC restored within next 6 months (up to 18 months after surgery).

To determine the individual indices of regional and central hemodynamics in patients of Group IA after caval plication, echocardiography and ultrasound were performed in the preoperative and postoperative periods. Surgical caval plication after thrombectomy of the IVC was found not to affect the venous return to the heart.

In the early postoperative period, the signs of CVI were observed in 5 (2.0%) out of 246 patients of Group IA. In the early postoperative period, there were no fatal cases as well as PE cases.

There were studied the results of surgery for DVT and PE prevention in 203 patients of Group IA in the remote postoperative period within 3 years. In 149 (73.4%) out of 203 patients, the results of surgical treatment of DVT of the IVC were evaluated as good, in 39 (19.2%) patients, they were evaluated as satisfactory and only in 15 (7.4%) patients,

they were unsatisfactory.

In 7 (3.4%) patients, the recurrence of DVT was observed. In 1 patient, it was caused by a long journey; in 6 patients, its causes were not found. Within 6 months after anticoagulation therapy, in all 7 patients, the signs of subtotal (n=5) and total (n=2) recanalization were seen.

In 17 (8.4%) patients, the signs of CVI in the remote period were observed. At the same time, in the remote postoperative period, according to ultrasound, the indices of regional and central hemodynamics did not differ from normal values. No fatal case and PE signs were observed in the remote period.

The cumulative analysis of the results of the postoperative period during 3 years of follow-up showed that good and satisfactory results of surgical treatment of DVT were observed in 89.3% of patients.

Prior to the discharge from the hospital, in 38 (76.0%) out of 50 patients of Group IB, the results of surgical treatment of DVT of the IVC were evaluated as good; in 12 (24.0%) patients, they were evaluated as satisfactory. In 4 (8.0%) out of 50 patients, there were observed local and general complications.

In 2 patients, after open thrombectomy from the CFV and intraoperative regional thrombolytic therapy, there was observed postoperative lymphorrhea in the inguinal region which stopped independently in 11 and 15 days, respectively. In one patient, there was found marginal necrosis of the postoperative wound in the inguinal region. In one patient, within 4 days after regional thrombolytic therapy and vena cava filter implantation, there were observed short-time local bleeding and small subcutaneous hematomas in the area of injections, that were eliminated through longer compression of injection sites.

After regional thrombolytic therapy, the total (90-100%) recanalization of affected venous segments was observed in 43 patients; subtotal (70-85%) recanalization was found in 5 patients; partial (35-50%) recanalization of affected venous segments was detected in 2 patients.

The duration of patients' stay at the hospital after combined treatment of thrombosis of the IVC ranged from 12 to 16 days, on average 13 ± 1.3 days. There were no lethal cases as well as cases of PE.

Twelve months after combined treatment, the results of treatment were evaluated in 46 patients of Group IB, 30 patients after vena cava filter implantation and regional thrombolytic therapy and 16 patients after thrombectomy and intraoperative regional thrombolytic therapy in particular. In 36 (78.3%) out of 46 patients, the results of combined treatment of DVT of the IVC were evaluated as good; in 6 (13.0%) patients, they were evaluated as satisfactory; in 4 (8.7%) patients, they were unsatisfactory. The complications were observed in 7 (15.2%) out of 46 patients.

In 30 patients with permanent vena cava filter, its status had been monitored by the end of the 1st year of observation. Vena cava filter migration was detected in 3 patients in the

early postoperative period - 2 patients after the implantation of vena cava filter "Greenfield" and 1 patient after the implantation of vena cava filter "Reptela". In 2 patients, vena cava filter migration into the left CIV occurred; in 1 patient, vena cava filter migration in the proximal direction into the suprarenal portion of the IVC was observed. During proximal vena cava filter migration, massive fatal PE was observed.

In one patient, thrombotic masses were observed, which, however, did not result in PE. In 2 patients, the signs of lumbar pain syndrome were found 2.5 and 3 months after the implantation of vena cava filter, respectively.

In 7 patients with subtotal or partial recanalization before their discharge from the hospital, total recanalization occurred in the early postoperative period - up to 6 months of follow-up.

In one patient, recurrent thrombosis was observed after open thrombectomy from the SFV and intraoperative regional thrombolytic therapy. Its manifestations were eliminated conservatively. During the 1st year of observations, there were no cases of PE in 16 patients after open thrombectomy combined with regional thrombolytic therapy. There were no fatal cases.

In the early postoperative period, CVI symptoms were observed in 2 (4.3%) of 46 patients of Group IB.

Thirty-six months after combined treatment, the results of treatment were evaluated in 11 patients of Group IB - 4 patients after vena cava filter implantation and regional thrombolytic therapy and 7 patients after thrombectomy and intraoperative regional thrombolytic therapy. In 4 (36.4%) out of 11 patients, the results of combined treatment of DVT of the IVC were evaluated as good; in 2 (18.2%), the results were assessed as satisfactory; in 5 (45.4%) patients, the results of combined treatment in the remote postoperative period were unsatisfactory. In 5 (45.4%) out of 11 patients, the complications were observed.

Migration of permanent vena cava filter "Osot" into the left CIV was detected in one patient in the remote postoperative period. However, it did not result in blood flow disturbance. In 2 patients, proximal vena cava filter migration and PE were observed. Both cases were fatal.

In 2 patients, recurrent thrombosis was observed after open thrombectomy from the PV and regional thrombolytic therapy. Its manifestations were eliminated conservatively. During the 1st year of observations, there were no cases of PE in 7 patients after open thrombectomy combined with regional thrombolytic therapy. There were no fatal cases.

In 3 (27.3%) patients, the signs of CVI were observed in the remote postoperative period.

According to the cumulative analysis, after combined treatment, good and satisfactory results in the remote postoperative period were achieved in 81.7% of patients.

Prior to the discharge from the hospital, in 114 (91.2%) out of 125 patients of Group IC, the results of surgical treatment of transfascial thrombosis were evaluated as good, in 8 (6.4%) patients, they were evaluated as satisfactory; in 3 (2.4%) patients, surgical treatment was unsatisfactory. The complications were observed in 10 (8.0%) out of 125 patients

operated on for transfascial thrombosis.

The most frequent complication was lymphorrhea, which was observed in 4 (3.2%) out of 125 patients including one patient with seroma formation. The average duration of lymphorrhea was 12 ± 1.4 days (10 to 23 days).

In 3 (2.4%) patients, there was found marginal necrosis of the postoperative wound in the inguinal region. In all patients, the effects of necrotic changes were eliminated using local therapy, the postoperative wounds at the site of marginal necrosis healed by secondary intention.

Recurrent thrombotic process in the immediate postoperative period was observed in 3 (2.4%) patients. Considering the fixed nature of the proximal portion of thrombotic masses, it was decided to continue conservative anticoagulant therapy.

The duration of patients' stay at the hospital after surgical treatment of transfascial thrombosis ranged from 10 to 14 days, on average 11 ± 1.2 days. There were no fatal cases as well as cases of PE.

The results of treatment of transfascial thrombosis in the early postoperative period up to 1 year were evaluated in 71 patients of Group IC up. In 68 (95.8%) patients, the results of surgical treatment were evaluated as good; in 2 (2.8%) patients, they were evaluated as satisfactory; in 1 (1.4%) patient, the results of surgical treatment were unsatisfactory. In the early postoperative period, the complications were observed in 2 (2.8%) patients.

Recurrence of the thrombotic process in the early postoperative period was observed in 1 (1.4%) patient as a result of self-cessation of anticoagulant therapy. Considering the fixed nature of the proximal portion of the thrombotic masses, it was decided to continue conservative anticoagulant therapy.

In one patient, 7 months after radical phlebectomy and thrombectomy from the the GSV, acute myocardial infarction occurred. The patient underwent X-ray contrast coronarography and coronary artery stenting. After 3 days, the patient was discharged to an outpatient program in a satisfactory condition.

There were no cases of PE or fatal cases during the observation in the early postoperative period. In 1 (1.4%) of 71 patients of Group IC, the signs of CVI were observed in the early postoperative period.

The remote results of surgical treatment of transfascial thrombosis were evaluated in 34 patients of the main group. In 31 (91.2%) patients, the results of surgical treatment of transfascial thrombosis were evaluated as good, in 2 (5.9%) patients, the results were evaluated as satisfactory; in 1 (2.9%) patient, they were unsatisfactory.

Recurrence of the thrombotic process in the tibial-popliteal segment was observed in one (2.9%) patient on the third year of follow-up. At the same time, the apex of thrombotic masses was fixed. The cause of recurrent thrombotic lesions was not found. The patient was prescribed anticoagulant therapy. In the remote postoperative period, there were no cases of PE or fatal cases.

In the remote postoperative period, the signs of CVI were

detected in 2 (5.9%) patients of Groups IC.

According to the cumulative analysis, good and satisfactory results of surgical treatment of transfascial thrombosis were observed in 88.4% of patients at the end of the third year of follow-up.

Prior to discharge from the hospital, in 7 (3.0%) of 235 patients of Group II, PE was observed on the background of anticoagulant therapy; 2 patients died. In 4 out of 5 patients who had an episode of nonfatal PE, there were observed the signs of disability during the next year of follow-up. Bleeding of varying intensity (blood in the urine (n=4), bleeding while teeth brushing (n=5), prolonged and heavy menstrual bleeding (n=4) and bleeding at the injection site (n = 9), post-injection hematomas (n=2)) was observed in 24 patients on the background of taking anticoagulants in the period up to 1 month; in all cases, it was stopped conservatively.

The results of conservative treatment during 12 months of observation were evaluated in 164 patients of Group II. Thus, good results of conservative therapy were found in 38 (23.2%) patients; in 71 (43.3%) patients, the results were satisfactory; in 55 (33.5%) patients, the results were unsatisfactory. Within 12 months of observation, recurrent thrombosis was found in 27 (16.7%) patients: 11 patients developed it on the background of conservative treatment; 16 patients developed thrombosis after conservative treatment cessation, 6 months after anticoagulation therapy. In 3 patients, on the background of recurrent thrombosis, the signs of PE were detected; one case of thromboembolism was fatal. In 2 patients who managed to save their life after PE, there were observed symptoms of disability.

By the end of the first year of follow-up, in 36 (22.0%) patients of the control group, significant clinical manifestations of CVI were found; in 7 (19.4%) patients trophic ulcers were observed. In the period up to one year, bleeding of varying intensity (blood in the urine (n=2), bleeding while teeth brushing (n=3), prolonged and heavy menstrual bleeding (n=2) and post-injection hematomas (n=1)) was observed in 8 (4.9%) patients on the background of anticoagulant therapy; in all cases, bleeding was stopped conservatively.

At the end of the 3rd year of observation, good results of conservative therapy were found in 9 (8.7%) patients; in 41 (39.4%) patients, they were satisfactory; in 54 (51.9%) patients, the results were unsatisfactory. By the end of the 3rd year of observation, recurrent thrombosis was detected in 7 (6.7%) patients. In 3 patients with recurrent thrombosis, the signs of PE were observed; one case of thromboembolism was fatal. In 1 patient out of 2, who managed to save their life after PE, there were observed symptoms of disability.

At the end of the 3rd year of follow-up, in 53 (51.0%) patients of Group II the signs of CVI were observed. 12 (22.6%) out of 53 patients of Group II developed trophic ulcers.

At the end of the 3rd year of observation, according to the cumulative analysis, good and satisfactory results of conservative treatment of DVT were observed in 35.3% of patients.

Thus, when comparing treatment results in the main and control groups, a significant improvement in the patients' condition in all parameters was observed in the main group. The early and long-term results obtained convincingly demonstrated high efficiency and expediency of using surgical treatment of DVT in comparison with isolated conservative treatment. In addition, surgical restoration of the venous lumen allows preserving the valvular apparatus of veins, preventing the development of PTS with the subsequent CVI occurrence, improving the results of treating patients with DVT significantly. Moreover, surgical methods of treating DVT of the lower extremities effectively prevent PE.

3. Conclusions

1. According to the cumulative analysis, surgical treatment of DVT of the lower extremities allowed us to achieve a positive result of treatment in 89.3% of patients, and conservative treatment of DVT of the lower extremities allowed us to achieve a positive result of treatment in 35.3% of patients only.
2. During 3 years of observation, the signs of CVI were observed in 51.0% of patients of the control group and only 8.4% of patients of the main group.
3. In quantitative evaluation of disease severity in groups of patients depending on the method of treatment, a significant improvement in the patients' condition in all parameters was observed in the main group as compared to the control one.

4. Prospects for further research

The development of minimally invasive methods for surgical treatment of DVT and prevention of PE with the aim of reducing the frequency of complications in the postoperative period is promising.

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