

COMPLEX RADIODIAGNOSIS AND SURGICAL TREATMENT OF THE PATIENTS WITH THROMBOSIS OF INFERIOR VENA CAVA SYSTEM

Despite of much effort, taken to improve diagnosis technologies, examination and development of the tactics for treatment of patients with acute inferior vena cava (IVC) thrombosis remain to be insufficiently understood. In period from 2003 there were examined and treated 572 patients with thrombosis of the IVC system. Thrombectomy was conducted in 62 (39.7%) cases, only clipping or plation without thrombectomy was made in 94(60.3%) of cases. After operation all patients showed regress of lower extremity deep vein thrombosis (LEDVT) clinical symptoms. In the postoperative period there were no thromboembolia of the pulmonary artery (PATE) events. All patients were discharged from hospital in satisfactory condition. On the basis of this clinical material we may suggest that choice of the technique of PATE surgical prophylaxis depends on the character and spreading of thrombus, functional-anatomic peculiarities of the IVC system.

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Introduction

There have been taken a lot of efforts to improve diagnosis technologies. However, the issue of treatment tactics for patients with acute thrombosis of the system of inferior vena cava remains to be insufficiently understood.

The floating (embolodangerous) thrombus in the iliofemoral or iliocaval segments of the system of inferior vena cava is the most dangerous type of lower extremity deep vein thrombosis (LEDVT). It is characterized by its floating part in the intensive blood flow that prevents from thrombus adhesion to the vascular wall. At present time there have been defined two types of embolodangerous thrombi: first is the most dangerous - segmentary floating thrombus, and secondary is common occluding thrombus with floating top (Kirienko, 2001). Isolation of the floating thrombi into separate group is necessary for development of indications for one or other method of prevention of thromboembolia of the pulmonary artery (PATE) and development of the tactics of LEDVT treatment.

At present time the non-invasive methods of investigation, such as color duplex scanning (CDS) and ultrasound dopplerography (USDG) have been widely spread in the diagnosis of venous thrombosis. And CDS in the diagnosis of thrombosis of the lower extremity deep veins of the femoral-popliteal segment due to its high sensitivity is considered as the method of choice. In USDG criteria for LEDVT are absence or reduction of flow velocity, absence or lowering of blood flow in performance of respiratory test, increase in blood flow or appearance of retrograde blood flow in compression of study segment (Shulgina, 2005; Aswad, 1996).

In spite of this fact, according to reports of many authors, the contrast phlebography (Prokubovskiy, 2001) does not lose its position in the diagnosis determination in the patients with LEDVT. Though it is considered "gold" standard in study of iliocaval segment this method is invasive and requires using of contrast iodine-containing preparations.

The paper aimed to evaluate informativeness, significance of ultrasound and roentgen contrasting methods of investigation in the patients with thrombosis of the IVC system. The results obtained were used for choice of the most optimal method for prevention of PATE and dynamic control of the treatment performed.

Material and methods

At the department of Vascular Surgery of the Republican Research Center of Emergency Medical Care beginning from 2003 five hundred and seventy two patients received treatment due to deep vein thrombosis of the inferior vena cava system. Of them 89 (15.5%) had the clinical picture of PATE. Women were 307 (53.7%), men – 265 (46.3%). The age of patients fluctuated from 16 to 90 years, on the average 50.3 ± 0.7 years. The pathological process localized more often on the left lower extremity - 378 (66.1%). Related to the level of lesion the patients were divided as shown in Table 1.

TABLE 1. DISTRIBUTION OF THE PATIENTS RELATED TO THE LEVEL OF THROMBUS LOCALIZATION

Level of thrombus localization	Patients number (%)
Inferior vena cava	3 (0.5%)
Iliac-femoral segment	346 (60.5%)
Femoral vein	40 (7.0%)
Popliteal vein	97 (17.0%)
Sural veins	86 (15.0%)
Totally	572 (100%)

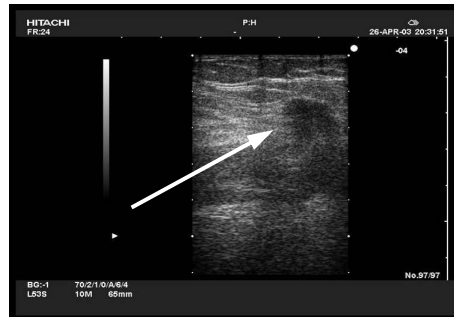
The most number of patients were with iliofemoral venous thrombosis (60.5%) and thrombosis of popliteal vein (17.0%). Thrombosis of sural veins in our series of investigation was diagnosed in 15.0% of cases.

The patients admitted to the hospital usually on the 2-3 day of disease - 279 (48.8%); on the 4-7 day - 183 (32.0%), more than 7 days of disease - 58 (10.1%). Unfortunately, on the first day of diseases onset only 52 (9.1%) patients admitted to the hospital. All the patients at the admission underwent all necessary clinical-laboratory methods of blood analysis. The Color duplex scanning was obligatory procedure and performed at the digital ultrasound scanner “EUB-6000” (“Hitachi”, Japan) with use of color (CDM) and energetic (EDM) mapping with linear 7.5 MHz and secretary 3.5 MHz sensors. Besides, the arsenal of diagnostic measures included roentgen contrasting retrograde ilio-cavography (RICG) and angiopulmonography (APG). Thrombus spreading above inguinal fold and presence of the clinical picture of thromboembolia of the pulmonary artery branches was indications for performance of roentgen contrasting methods of investigation. For determination of the level of thrombus localization in the ilio-caval segment and its embolodangerous RICG was performed in 54 (9.4%) cases. APG was used in 26 (4.5%) cases. Investigations were made on the angiography device “ICONUS 200” (“Siemens”, Germany).

Results

The color duplex scanning was performed in 466 (81.4%) from 572 patients admitted into our clinic with deep vein thrombosis of inferior vena cava. The floating thrombus was revealed in 78 (16.7%) cases and the parietal thrombus of different localization was found in 70 (15.0%) cases. In floating thrombus the “head” of thrombus was visualized as hyperchogenous mass of oval form in the vein patency (Figure 1), and in some cases its fluctuating movements may be visualized, that was very hazardous indicator, because the threaten of thrombus avulsion was very high.

FIGURE 1. CDS OF THE FEMORAL VEIN. "HEAD" OF THE FLOATING THROMBUS IS SHOWN BY THE ARROW



In spite of difficulties in visualization of the ilio caval segment in 7 cases the floating thrombus was revealed in the patency of inferior vena cava. Unfortunately, in the majority of cases in attempt to get visualization of inferior vena cava the difficulties occurred due to absence of appropriate preparation (intestinal gases) of the patient or his big weight. At the rest 71 cases of floating thrombus visualization there were found the regularities, presented in Table 2.

TABLE 2. FREQUENCY RATE OF FLOATING BLOOD CLOTS IN THE IVC SYSTEM

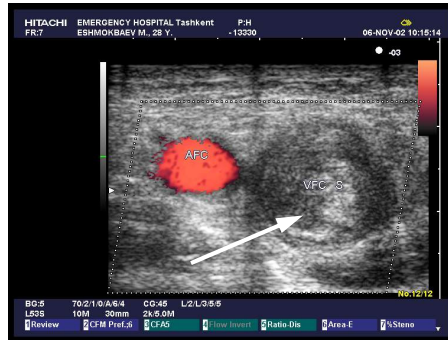
Blood clot localization	Number of the patients with LEDVT	Number of the patients with floating blood	%
Iliac vein	346	39	11.3
Femoral vein	40	32	80.0

The highest informativeness (80.0%) was noted in duplex scanning of the femoral vein. The duplex scanning allowed visualization of the venous system in the regimen of real time, to define the level of localization and stage of thrombus formation as well as dynamic observation of thrombus during the process of treatment. The availability of the femoral vein for color duplex scanning gave an opportunity to observe and prognosis of the outcome of thrombi in the popliteal vein, and sometimes, in the sural veins in cases of their increase in the proximal direction. The relatively (11.3%) low frequency of floating thrombus identification was noted in the area of iliac vein. However, this percent does not reflect the whole complexity of location of this segment of the system of deep veins of the lower extremity system. The floating thrombi in CDS were found more frequent in the first segment of the iliac vein, that is, just after inguinal fold. The considerable difficulties were noted in locating of the iliac vein at the place of junction with IVC. The pneumatosis of the intestine and significant depth of their location were the factors which presenting difficulties for precise diagnosis.

In 318 cases (68.2%) in CDS of the popliteal, femoral and ileal segments there were occlusive thrombi (Figure 2). They were characterized by absence of the blood flow in the vein, well outlines thrombus borders that had no embolodangerous "head". In the control dynamic investigation there was noted mostly frequent gradual formation of thrombus without growing in the proximal direction with more closed it adhesion to the vein wall. In the majority of cases in diagnosis of these forms of venous thrombosis with absence of

growing in the proximal direction and clinical picture of embolism of the pulmonary artery branches the conservative methods of treatment were used.

FIGURE 2. CDS OF THE FEMORAL VEIN. THE ARROW SHOWS THE OCCLUSIVE THROMBUS OF THE COMMON FEMORAL VEIN (FVC). THE BLOOD FLOW PRESERVED IN THE COMMON FEMORAL VEIN TRACK (AFC)



Taking into account that visualization of the iliac veins and inferior vena cava is not always clear and has restrictions in 58 (10.1%) cases there was performed RICG. The main indications for performance of this investigation were as follows:

1. impossibility to clear ultrasound visualization or signs of growing proximal end of thrombus in the iliac vein or IVC;
2. suspicion of presence of the floating thrombus in the iliac vein and IVC;
3. determination of the source of clinical signs of embolism of pulmonary artery branches.

During performance of RICG in 56 (96.5%) cases there was revealed pathology of ilio caval segment. In 27 (48.2%) cases there was found floating thrombus IVC with thrombus in one of the iliac veins that indicated about gradual growing of pathological process in the lower levels of the deep vein system (Figure 3). In 11 (19.6%) cases the floating thrombus localized in the iliac vein (more frequently in the common iliac vein). In the rest 18 (32.2%) cases of RICG there was revealed occlusive thrombus of IVC in 3 (5.4%) and iliac vein in 15(26.8%) cases. Only in 2 (3.5%) cases with clear signs of thromboemboli of pulmonary artery branches there was no pathology in the ilio caval vein. It is possible that we diagnosed the case when floating part of thrombus “head” tearing off entered the system of pulmonary artery, and in ilio caval segment thrombi were not visualized in RICG.

Taking into account that in the majority of cases indications for performance of roentgen contrast method of investigation included not only presence of diagnosed acute iliofemoral thrombus but also clinical signs of thromboemboli of the pulmonary artery branches and in 26 (44.8%) cases these patients were performed APG.

The relative simplicity of the performance of examination through the same paracentetic access allowed carrying out of investigation immediately after RICG. In 24 (92.3%) cases there were found signs of PATE. And in 4 (16.7%) patients there were noted thromboembolia of one of pulmonary arteries (Figure 4). In the rest 20 (83.3%) patients the segmentary branches of the pulmonary artery were damaged. In 2 (7.7%) cases in presence of clinical picture of PATE being performed (roentgenological signs of pneumonia, discharge of rusty sputum, presence of respiratory insufficiency indicators of

saturation) the pathology in APG was not diagnosed in patients that may be connected with emboly of the ending branches with small thrombus or lysis of small thrombus on the basis of the performed conservative measures.

FIGURE 3. ROENTGENOCONTRAST ILOCAVOGRAPHY. THE ARROW SHOWS EMBOLODANGEROUS "HEAD" OF THE FLOATING THROMBUS AT THE LEVEL OF TIII OF LUMBAR SPINE



FIGURE 4. ANGIOPULMONOGRAPHY. THE ARROW SHOWS EMBOLI, OCCLUDING PATENCY OF THE LEFT PULMONARY ARTERY



For determination of the tactics of therapeutic measures in those or other forms of thrombosis of the deep veins of lower extremities the data of instrumental methods of examination had the decisive role. During diagnosis of the cases hazardous for patients' life (presence of floating thrombus, growing of thrombus "head" in the proximal direction in dynamic control, diagnosis of thromboemboli of one of the trunk or branches of pulmonary artery) the surgical prevention performed for carrying out prevention of massive (fatal) PATE.

We performed the following operations (n=156): thrombectomy with placation IVC in 8 cases, IVC placation - in 6, thrombectomy with cava clipping - in 25, cava clipping - in 60, cava clipping with pregnancy interruption - in 3, cava clipping with uterus extirpation - in 4, cava clipping with uterus amputation - in 6, thrombectomy with plication of common iliac and superficial femoral veins - in 29 and placation of superficial femoral vein - in 15 cases.

At the initial steps of our work we routinely performed radical thrombectomy from IVC, iliac and femoral veins in all operated patients with threaten of PATE. However, due to marked inflammatory process the performance of thrombectomy was failed some times and was not "radical" enough. Therefore thrombectomy was performed in 62 (39.7%) cases. Taking into account that 42.1% of patients were admitted to our clinic 72 hours later from disease onset, and in 94 (60.3%) cases we limited by clipping or placation of vein without additional thrombectomy. In our opinion, the performance of thrombectomy in late period from onset of disease additionally to marked inflammation process may result in vein injury that, in its turn, will result in rethrombosis and more severe clinical course of disease.

All the patients received intensive conservative therapy that included anticoagulant (clexan), rheological, disaggregant, spasmolytic and anti-inflammatory therapy. On the basis of therapy performed, particularly in patients who were carried out clipping or placation of the iliac vein or IVC with thromboectomy during the first days after operation there was noted quick regress of edema and normalization of the skin color of the lower extremity. On the second day the patients after operation were activated in the

elastic bandage, and non-operated patients were prescribed the bed regimen during 10 days from disease onset with raised position of the extremity. After operation the patients with thrombosis of the deep veins of the lower extremities were under inpatient condition during 6-8 days.

In the postoperative period there were noted following complications: lymphorrhea - 2, hemoptysis - 1. The microembolic events of the pulmonary artery branches in the postoperative period were observed in one patient who underwent IVC placcation. The lethal outcome was noted in one patient having operation due to floating thrombus and in 4 patients with deep vein thrombosis of the lower extremities. The causes of death in these cases were increasing signs of acute heart and respiratory insufficiency.

Discussion

The issues connected with deep vein thrombosis of the lower extremities and its dangerous complications PATE remain to be one of the complex problems of the current phlebology. At present time it is considered that LEDVT and PATE are direct cause of the death one from 1000 residents of the planet (Kirienko, 2001; Bounameaux, 2001), PATE is the cause of death in 5% of patients after general surgical and in 23.7% ones after orthopedic operations (Yakovlev, 1998). In spite of all efforts of researchers and introduction of the modern technologies into the clinical practice the identification of "embolodangerous" thrombus and tactics of the preventive measurements are the most difficult moments in providing care for these patients. Introduction over the last time of the ultrasound methods of diagnosis into the clinical practice have changed a lot of earlier approved standards.

At present the duplex scanning (DS) with use of CDS and EDM are the most informative noninvasive methods in the diagnosis of LEDVT. In localization of the thrombosis below the level of inguinal fold this technique allows correct resolving of all the issues of diagnosis determining tactics of treatment. The advantage of this investigation is providing opportunity of multiple repeated examination of the venous system that allows observation during the process of thrombus formation, growing, lysis and organization, and, consequently, correction of the therapeutic strategy. CDS is useful and precise method of examination (Shulgina et al., 2005; Frielland et al., 1996), and diagnostic accuracy and sensitivity are 97.5%, respectively. In thrombus localization above the inguinal fold the diagnostic value of this method reduces to 89% and in 11% of cases examination seems to be inadequate due to intestinal gases (Kazmers, 2000).

The highest informativeness (80.0%) of the floating thrombus in our investigation was noted in duplex scanning of vein in the popliteal-femoral segment and relatively low (11.3%) identification rate of the floating thrombus was found in location of the iliac vein.

In the cases when the thrombosis spread over the ilio caval segment as well as presence of PATE clinical features it is necessary to perform roentgen contrasting methods of examination (RICG and APG). Retrograde iliocavography allows precisely determine proximal border and thrombus type (occlusive, parietal and floating) and is considered as one of the main methods of identification of the cause of pulmonary embolism (Prokubovskiy, 2001). The results of phlebographic examinations show necessity and character of prophylactic intervention into the venous system: implantation cava filter, catheter thrombectomy, cava clipping, placcation or ligation of the veins (Saveliev, 2000; Ravitch, 1966). APG allows with reliability of high degree confirmation or rejection of the diagnosis of pulmonary emboly, evaluation its character and total volume of pulmonary vascular bed impairment, and in some cases, if it is necessary, transition from diagnostic procedure to the therapeutic (Prokubovskiy, 2001). In our study during performance of roentgen-contrasting examinations (RICG and APG) floating thrombus was identified in 67.8% and PATE in 92.4% of cases.

On the basis of this clinical material we may suggest that choice of the technique of PATE surgical prophylaxis depends on the character and spreading of the thrombus, functional-

anatomic peculiarities of the IVC system, which besides clinical data is revealed with use of CDS, RIGG and APG.

Conclusion

Color duplex scanning is one of the informative methods of diagnosis of venous thrombosis below the level of inguinal fold.

Roentgen contrasting ilio-cavography and angiopulmonography are the “gold” standard in the emergent phlebology during examination of ilio-caval segment and branches of pulmonary artery.

While identification of embolodangerous thrombus it is necessary to perform surgical prophylaxis of thromboembolia of the pulmonary artery.

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