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PREVENTION AND TREATMENT OF THROMBOEMBOLIC COMPLICATIONS IN SURGICAL PATIENTS

Abstract. *The concept of "venous thromboembolism" combines thrombosis in the superior or inferior vena cava systems, which is often complicated by acute occlusion, thrombus or embolus of the trunk or branches of the pulmonary artery.*

Pulmonary embolism is an acute obstruction of the pulmonary vessels and ischemia of tissues excluded from blood circulation due to blockage of the pulmonary artery by an embolus, which is part of a thrombus that broke away from the main source and migrated with the blood stream. The source of thromboembolism in 66–100% of cases is the inferior vena cava system.

Keywords: *pulmonary embolism, thrombolytic therapy, thrombosis, risk, prevention, treatment, a surgical profile.*

Epidemiology. In the world, pulmonary embolism (PE) is considered the third most common cause of death. According to the Framingham study (2022), mortality from PE makes up to 15.6% of all hospital mortality (18% – surgical profile patients, 82% –therapeutic pathology). There are no accurate statistical data on the frequency of cases of PE in Ukraine, and the probable incidence of the disease is about 50,000 cases per year, including with a fatal outcome – more than 10,000. In Ukraine, the development of PE complicates 0.1–0.3% operative interventions and is the cause of 20–40% of death in the postoperative period.

Risk factors. Primary ones include: anti-thrombin deficiency, congenital dysfibrinogenemia, thrombomodulin deficiency, hyperhomocysteinemia, antibodies to cardiolipin, increased activity of plasminogen activator inhibitor, mutation 20210A prothrombin, protein C deficiency, factor V Leiden, plasminogen deficiency, dysplasminogenemia, protein S deficiency, factor XII deficiency. A group of secondary factors risk factors include: trauma/fractures, stroke, advanced age, presence of a central venous catheter, chronic venous insufficiency, smoking, pregnancy/postpartum period, Crohn's disease, nephrotic syndrome, increased blood viscosity, platelet disorders, surgical interventions, immobilization of the patient, malignant neoplasm and chemotherapy, obesity, heart failure, taking oral contraceptives, systemic lupus erythematosus, presence of artificial implants, long-distance travelling.

Diagnostics. Laboratory diagnostics include: thrombin-antithrombin complex,

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fibrinopeptide A, soluble fibrin-monomeric complexes, however, of greatest importance is the determination of D-dimer in blood plasma. Instrumental methods include: electrocardiography (ECG), chest X-ray, echocardiography, catheterization of the right heart, ventilation and perfusion scintigraphy of the lungs, angiopulmonography, computed tomography (CT), ultrasound of the lower extremities' veins, X-ray contrast phlebography.

Diagnostic strategies. In hemodynamically unstable patients with suspected PE the most optimal method for starting diagnostics is echocardiography, which in most cases allows to detect indirect signs of pulmonary hypertension and right ventricle (RV) overload, as well as exclude other causes of instability. Echocardiography can be the basis for establishing a diagnosis of PE and starting thrombolytic therapy in the absence of other diagnostic methods or the impossibility of rapid stabilization of the patient's condition. In all other cases a CT scan is necessary. Diagnostic strategy in hemodynamically stable patients with suspicion of PE begins with determining the probability of this disease on the basis clinical data. For this purpose, it is advisable to use the P.S. Wells PE score. In patients with a positive level of D-dimer, multidetector CT is recommended, based on the data of which make a conclusion about the expediency of carrying out specific therapy.

Treatment. Main aspects of thrombolytic therapy: therapeutic "window" for implementation of thrombolytic therapy in patients with PE is up to 14 days from the symptoms' onset (shown to all patients with massive PE). Most contraindications for conducting thrombolytic therapy for massive PE are relative. Taking into account the efficiency and safety, the best mode of thrombolytic therapy is the systemic administration of 100 mg alteplase for 2 hours. Effectiveness of thrombolytic drugs in patients with submassive PE has not been proven, but in connection with clinical expediency, therapy can be carried out at the discretion of the doctor. Thrombolytic therapy is not shown to be hemodynamically stable patients without signs of RV overload/dysfunction.

Anticoagulant therapy. First, 5–10,000 international units (IU) of heparin are administered intravenously as a bolus. Then intravenous drip administration of the drug is started. Initial infusion rate depends on the patient's body weight and is calculated according to the nomogram. Heparinotherapy is performed under the mandatory control of the activated partial thromboplastin time (APTT) indicator (every 4-6 hours). It is recommended to maintain the APPT index at a level 1.5–2.5 times higher than the control value for this laboratory. In patients with massive PE, the tactics of heparin therapy should be even more aggressive. At the same time, it is recommended to use a dose not lower than that for bolus administration 10,000 IU, and the target level of APPT during infusion therapy should be at least 80 seconds. Heparin therapy must be carried out within 7–10 days, because it is during these times lysis and/or thrombus organization occurs.

Of the low molecular weight heparins (LMWH) registered in Ukraine today, the most studied for the treatment of patients with deep vein thrombosis and PE is enoxaparin (1 mg/kg body weight after 12 hour or 1.5 mg/kg 1 once a day). The duration of treatment with LMWH is 5–10 days.

An alternative method of anticoagulant therapy in PE is the use of a selective inhibitor of blood coagulation factor X - fondaparinux. Its subcutaneous introduction in fixed dose (5 mg for patients with body weight <50 kg, 75 mg – 50–100 kg, 10 mg – >100 kg) once daily will

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be as effective as low-fractionated heparins (LFH) administration.

Simultaneously with the use of heparin, patients with PE are prescribed indirect drugs anticoagulants, the mechanism of action of which is to disrupt the normal metabolism of vitamin K in the liver. The initial dose of warfarin in patients with PE is usually 5 mg. If a bleeding occurs while taking indirect anticoagulants, taking these drugs must be terminated. An antagonist of indirect anticoagulants – vitamin K– is administered intravenously in a dose of 5–10 mg daily. It should be remembered that the maximum effectiveness of the drug is noted only 20-24 hours after the introduction. Therefore, to urgently stop the bleeding it is necessary to transfuse fresh frozen blood plasma at a dose of 10–20 ml/kg of body weight, while starting vitamin K therapy.

Prevention of PE: early mobilization, mechanical methods (elastic stockings with graduated compression, equipment for intermittent pneumatic compression of the lower and upper extremities), anticoagulants (heparins – LFH/LMWH); selective inhibitors of factor Xa; vitamin K antagonists; direct oral thrombin inhibitor. Combination of mechanical and pharmacological methods is more effective than the use of only one method, and recommended for patients burdened with a high risk of developing venous thromboembolism (VTE). Prevention in patients with a surgical profile, as a rule, begins before surgery intervention or a few hours after it and is used until the time of full mobilization of the patient, and in the case of major orthopedic operations within ≥10–14 days. Choice of method depends on the degree of threat of thrombosis (a modified Caprini risk assessment score).

Conclusion. Analyzing all the reviewed information, we can conclude that prevention and timely treatment are integral components of VTE prevention in surgical patients.

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