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THE IMPORTANCE OF CT ANGIOGRAPHY AND ECHOCARDIOGRAPHY IN THE EARLY DETECTION OF SUDDEN PULMONARY EMBOLISM IN CHRONIC HEART FAILURE.

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Abstract: Pulmonary artery thromboembolism (PATE) is an acute pathological condition resulting from the occlusion of the pulmonary artery by thrombus masses, which leads to serious morphological changes. This article reviews the etiology and pathogenesis of PATE, morphological changes in lung tissue, and their use in diagnosis. The role and significance of diagnostic tests, as well as the effectiveness of various therapeutic approaches, are also discussed through a comparison of various studies and experimental results. Pulmonary thromboembolism (PTE) is an urgent pathology with a high mortality rate and requires prompt diagnosis. Early detection of the disease and proper treatment significantly reduce the risk of death and complications. Computed tomography angiography (CT angiography) is currently considered the "gold standard" for the diagnosis of PTE. This article reviews the diagnostic capabilities of CT angiography, its sensitivity and specificity, and the impact of contrast media on the diagnosis of PTE.

The results of the study demonstrate the high efficiency of CT angiography in detecting small and segmental thromboemboli at an early stage. It is also justified that additional assessment of perfusion disorders is important in clinical decision-making. The obtained data confirm that early detection of pulmonary embolism using CT angiography is the most optimal and reliable method in clinical practice.

Keywords: Pulmonary artery thromboembolism, streptokinase, hypoxic thrombolysis, early diagnosis, D-dimer, CT angiography, hypoxemia, right heart failure, revascularization.

Introduction. Pulmonary embolism (PE) is a serious condition resulting from the blockage of a pulmonary artery or its branches by a blood clot, most often as a complication of deep vein thrombosis. According to the World Health Organization (WHO), PE is the third leading cause of sudden death among cardiovascular diseases, after heart attack and stroke. This condition requires rapid diagnosis and urgent treatment, especially in patients in high-risk groups (post-surgical period, immobilization, oncological diseases, pregnancy).

The clinical picture of OATE can be diverse: shortness of breath, chest pain, hypoxemia, tachycardia, signs of strain in the right side of the heart, sometimes sudden fainting. Since these signs can be confused with other diseases (infarction, pneumonia, aortic dissection), accurate and early diagnosis is difficult. Therefore, in modern medicine, methods such as D-dimer tests, electrocardiography (ECG), computed tomography angiography of the chest (CT-angiography) and transthoracic echocardiography play an important role in diagnosis.

Early detection of OATE is crucial in saving the patient's life. Rapid thrombolysis is a treatment method aimed at opening the pulmonary artery by intravenously administering drugs that break down blood clots (alteplase, streptokinase, urokinase). It reduces pressure in the right ventricle of the heart, reduces arterial hypertension, relieves respiratory failure, and restores oxygen supply to vital organs.

Streptokinase is a metal-containing enzyme secreted by β-hemolytic streptococci, which is used as an inexpensive and widely available agent for thrombolytic therapy. It belongs to the group of fibrinolytic enzymes. It converts inactive plasminogen to its active form, plasmin.

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However, thrombolytic therapy should be used with caution in patients with a high risk of bleeding. Therefore, the decision to perform thrombolysis should be made in each clinical case, taking into account the patient's condition, risk level, and the presence of contraindications. The selection of thrombolysis strategy in OATE, criteria for assessing effectiveness, and analysis of clinical cases are the main focus of the article. Pulmonary embolism (PE) is one of the most lethal cardiovascular diseases. It is usually caused by the migration of blood clots from the veins of the legs or pelvis to the pulmonary artery. Therefore, this condition is more common in patients with delayed diagnosis of deep vein thrombosis, postoperative immobilization, pregnancy, overweight, and older age. Early diagnosis of PE is difficult due to the lack of specificity of clinical signs and the similarity of symptoms with other cardiovascular and respiratory diseases.

Importance of diagnostic tests: To diagnose OATE, clinical risk assessment systems such as the Wells score or the Geneva score are initially used based on the patient's clinical condition. Based on these methods, the patient is classified into low, intermediate, or high risk groups. The following steps are then performed:

• **D-dimer test:** This test detects fibrin breakdown products that are produced by blood clot formation. An elevated D-dimer level may indicate the presence of ATE, but it is used to rule out ATE in low-risk patients, as this parameter can also be elevated in other conditions.

• **CT angiography** (computed tomography angiography): This is the “gold standard” for diagnosing OATE. It assesses the location, size, and spread of the blockage (thrombosis) in the pulmonary artery.

• **Echocardiography**: It reveals right heart loading, ventricular dilation, and decreased cardiac output.

• **Spiral CT,** ventilation-perfusion scans (V/Q scan): Used in cases where CT angiography is not possible.

Rapid thrombolysis — refers to the treatment of OATE with drugs that dissolve the clot to restore blood flow. The following drugs are usually used: • Alteplase (tPA) • Streptokinase • Urokinase Thrombolytic therapy is the first-line treatment, especially in life-threatening OATE (e.g., hypotension, shock, cardiac arrest). By dissolving the clot, the pulmonary artery is opened, the right side of the heart is relieved, oxygen delivery is restored, and respiratory failure is reduced.

Thrombolysis algorithm: 1. The patient is given an IV thrombolytic (e.g., alteplase 100 mg over 2 hours).

2. Blood pressure, heart rate, ECG, oxygen levels, and bleeding risk are monitored throughout the procedure.

3. After 24–48 hours, the effectiveness of treatment is assessed using CT angiography or echocardiography.

4. If thrombolysis is ineffective or the patient has contraindications, catheter-based thrombectomy or surgical intervention is considered. Although immediate thrombolysis is effective in restoring cardiac function, reducing mortality, and preventing long-term complications, it carries risks such as bleeding (hemorrhagic stroke, internal bleeding). Therefore, caution should be exercised in the following situations:

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• Recent head injury or stroke

• Surgery (last 2–3 weeks)

• Active bleeding Therefore, an individual assessment for each patient is necessary. Several large clinical trials (PEITHO, MOPETT, etc.) have proven the effectiveness of thrombolysis in OATE. According to the PEITHO study, in patients with moderate-risk OATE, thrombolysis significantly reduced the incidence of right heart failure and the need for resuscitation, but increased the risk of bleeding. Also, in recent years, minimally invasive thrombectomy techniques (e.g., catheter-based aspiration thrombectomy) have been widely used. These techniques have a lower risk of bleeding and are an effective alternative for patients who cannot receive thrombolytic therapy.

Treatment. In modern practice, the following steps are followed in the treatment of OATE:

1. Urgent diagnosis: clinical scoring + D-dimer + CT-angiography

2. Treatment selection based on hemodynamic status: low, intermediate or high risk

3. Thrombolysis or anticoagulant therapy: based on the patient's risk

4. Rehabilitation and long-term anticoagulation: warfarin, NOAC (rivaroxaban, apixaban) Pulmonary embolism (PE) is a high-mortality emergency, and early detection and treatment with effective thrombolytic therapy can dramatically change the outcome. Rapid diagnostic algorithms, such as the Wells or Geneva scores, D-dimer testing, and CT angiography, can improve the detection rate.

Conclusion.

Pulmonary artery thromboembolism is a polyetiological disease, the development of which is associated with both acquired and hereditary risk factors. Understanding the clinical and genetic risk factors of OAT is important in choosing a preventive and treatment algorithm for patients. Some researchers suggest that certain gene polymorphisms are associated with a more severe course of the disease. A thorough study of the pathomorphological changes associated with OAT is important for understanding the pathogenesis of the disease, early diagnosis and development of effective treatment methods. Studies show that timely detection and treatment of thromboembolic processes can significantly reduce mortality. Therefore, future studies in the field of pathological anatomy and morphology should be aimed at better understanding the disease and its prevention.

References:

1. Konstantinides SV, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism. Eur Heart J. 2020;41(4):543– 603.

2. Jaff MR, McMurtry MS, Archer SL, et al. Management of massive and submassive pulmonary embolism. Circulation. 2011;123(16):1788–1830.

3. Meyer G, Vicaut E, Danays T, et al. Fibrinolysis for patients with intermediate -risk pulmonary embolism. N Engl J Med. 2014;370(15):1402–1411.

pISSN:2349-5707 Volume:13,Issue 2, February -2026 eISSN:2349-5715

4. Goldhaber SZ, Visani L, De Rosa M. Acute pulmonary embolism: clinical outcomes in the International Cooperative Pulmonary Embolism Registry (ICOPER). Lancet. 1999;353(9162):1386–1389.

5. Piazza G, Goldhaber SZ. Management of submassive pulmonary embolism. Circulation. 2010;122(11):1124–1129.

6. Kucher N, Rossi E, De Rosa M, Goldhaber SZ. Massive pulmonary embolism. Circulation. 2006;113(4):577–582.

7. Tapson VF. Acute pulmonary embolism. N Engl J Med. 2008;358(10):1037–1052.

8. Windecker S, Kolh P, Alfonso F, et al. ESC/EACTS Guidelines on myocardial revascularization. Eur Heart J. 2014;35(37):2541–2619.