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Pulmonary embolism: diagnosis and treatment

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ABSTRACT

Pulmonary embolism is occlusion of one or more pulmonary artery . Deep vein thrombosis is responsible for most cases of PE. Pulmonary embolism is in 50% cases asymptomatic. Risk factors are: surgery, trauma, venous catethers, superficial vein thrombosis,, immobilization, obesity, policythemia vera, infection, cancer, hormonal contraceptives. The aim of this paper is to present available diagnostic tools and treatment method of pulmonary embolism.

Nowadays, there are many tools, such as ECG, laboratory markers or imaging technique, which help us in diagnosis of pulmonary embolism. They consist of: ECG, laboratory markers and imaging techniques. D-dimer are standard laboratory test in diagnosis of PE. D-dimer has high diagnostic sensivity and is usually used to exlude PE. Ultrasonography is also useful for detection of PE. Ultrasound is non-invasive technique, which can be performed by the bed or during surgery. More advanced techniques of imaging, such as ventilation-perfusion scan or computed tomography pulmonary angiogram (CPTA) are also used in diagnosis of pulmonary embolism. Method of treatment depends on patients state and comorbidities: anticoagulation, thrombolysis, surgical embolectomy and cathether-directed thrombolysis,
Pulmonary embolism is often diagnosis of exclusion. Nowadays, with development of imaging techniques and laboratory tests, diagnosis of PE and proper treatment may be implemented quickly.

KEY WORDS: *deep vein thrombosis, pulmonary embolism, treatment*

INTRODUCTION

Pulmonary embolism is occlusion of one or more pulmonary artery . Deep vein thrombosis is responsible for most cases of PE. [1] In United States 300,000-600,000 people per year are diagnosed with PE. [2] Among people undergoing surgery incidence of pulmonary embolisms is 0,3% up to 1,6%. [3] Mortality rate in stable patients is 2%, but when hemodynamic instability occurs mortality rate is up to 65%. [4]
Pulmonary embolism is in 50% cases asymptomatic. Symptoms of pulmonary embolisms are chest pain, dyspnea, caugh, hemoptysis and syncope. [5] Physical findings are tachycardia, tachypnea, fever and hypoxia, rales, jugular venous distention. Risk factors are: surgery, trauma, venous catethers, superficial vein thrombosis,, immobilization, obesity, policythemia vera, infection, cancer, hormonal contraceptives. [6]

PURPOSE OF THE PAPER

The aim of this paper is to present available diagnostic tools and treatment method of pulmonary embolism.

STATE OF KNOWLEDGE:

DIAGNOSIS

Nowadays, there are many tools, such as ECG, laboratory markers or imaging technique, which help us in diagnosis of pulmonary embolism. They consist of: ECG, laboratory markers and imaging techniques.
The most common **ECG** change is the S1Q3T3 pattern - sign of volume and pressure overload of the right heart. S wave in lead I represents incomplete right bandle branch block, and Q wave with T-wave inversion in lead III are due to repolarization abnormalities within the right ventricle [2]. Arrythmias, such as atrial fibrillation/flutter or first, second or third degree heart block are observed in 5 to 10% patients.[3]
Useful laboratory markers are: D-dimer, troponin T and I, brain natruretic peptade and gas blood analysis. **D-dimer** are standard test in diagnosis of PE. D-dimer has high diagnostic sensivity and is usually used to exlude PE. It has low diagnostic specificity and may be elevated in conditions such as trauma, sepsis, cancer or during surgery. [6] Presence of pulmonary embolism can be ruled out if D-dimer test is negative, but if levels are elevated we

may only suspect PE. [3] **Troponin T and I, brain natriuretic peptade** are laboratory markers, which may be elevated if right ventricular disfunction is present. [5] Their high levels are also connected with increase in death, use of catecholamine and resuscitation. [3] High plasma lactate concentration, marker of tissue hypoxia, is another valuable test and its high levels are connected with increased in-hospital morality. [1] Gas blood analysis may reveal hypoxia, elevated alveolar-arterial gradient, hypocapnea [6] and respiratory alkalosis [7].

Chest x-ray may also be useful, but findings are usually non-specific. Findings include: a wadge-shaped infarct, platelike atelectasis, pleural effusions, elevation of hemidiaphragm. [4] Moreover chest x-ray can confirm other diseases, such as pneumonia, heart failure or pneumothorax. [5]

Ultrasonography is also useful for detection of PE. Ultrasound is non-invasive technique, which can be performed by the bed or during surgery. By performig an ultrasound examination we can detect signs of right heart failure, and with use of tranesopageal ultrasound detection of massive pulmonary embolism is possible. [4] Most common findings are: right ventricle dilatation, ventricular septal shift and tricuspid regurgiation. These techniqe of imaging may also help us to rule out other possible diagnosis, such as hypovolemia, aortic dissection, pericardial disease and valvular insufficiency. [3]

More advanced techniques of imaging, such as **ventilation-perfusion scan** or **computed tomography pulmonary angiogram (CPTA)** are used in diagnosis of pulmonary embolism. Superiority of CTPA is that with use of this modality we are able to detect alternative diagnoses . Limitations of V/Q scan is presence „intermediate probability" result, which means that we cannot neither confirm nor rule out pulmonary embolism. On the other hand, during V/Q scan there is no exposure to radiation. [5] V/Q scan is chosen if contraindations to CPTA are present, such as pregnancy , renal insufficiency or dye allergy. [8]

TREATMENT

Method of treatment depends on patients state and comorbidities: anticoagulation, thrombolysis, surgical embolectomy and cathether-directed thrombolysis,

Anticoagulation is first method of treatment. Unfractionated heparin, low molecular weighted heparin or direct oral anticoagulants are available in treatment of pulmonary embolism. Duration of therapy depends on the cause of pulmonary embolism and possibility of recurrance after discontinuation of anticoagulation. For example, three months of treatment is recommended in patients with provoked PE associated with surgery and in non-surgical patients with transient risk factors. Longer anticoagulation is recommended for patients with PE and active cancer. [5]

Indications for **systemic thrombolysis**, with use of agents such as streptokinase, urokinase and recombinant tissue plasminogen activator, are normotension and right ventricular dyfunction. Systemic thrombolysis is effective, but best outcomes are when infusion is started within 48 hours of the onset of symptoms. [9] Contraidactions to systemis thrombolysis are : dissecting aortic aneurysm, prior intracranial bleeding, cerebrovascular accident within 2 months, active bleeding, head trauma, known intracranial neoplasm, arteriovenous malformation. Relative contraindications are: pregancy, active peptic ulcer, severe hypertension, recent invasive procedures, major surgery or bleeding within 6, recent organ biospy, recent cardiopulmonary resuscitation, diabetic retiopathy and age> 75 years. [4]

Catether-directed trombolysis is as effective as systemic thrombolysis. This method is usually reserved for patients with hypotension and high risk of bleeding and in case of

unsuccessful systemic thrombolysis. [6] Agents are administered through catether directly into pulmonary artery at the site of embolus. This method of treatment is connected with lower in-hospital mortality and lower risk of major bleeding than systemic thrombolysis , but risk of major intracranial hemorrhage is almost the same. [5]

Indications for **surgical embolectomy** is massive pulmonary embolism with hemodynamic instability. Embolectomy is method of choice in cases of failed thrombolysisor cathether-assisted embolectomy or in patients who underwent surgery within 10 days. Massive pulmonary embolism during pregancy is also indication for embolectomy. This method in contrast to thrombolysis avoids risk of major uterine bleeding. During pulmonary embolectomy patients are at high risk of cardiopulmonary arrest. [10]

SUMMARY

Pulmonary embolism is often diagnosis of exclusion. Nowadays, with development of imaging techniques and laboratory tests, diagnosis of PE is easy and proper treatment may be implemented quickly. Method of treatment depends on severity of PE and comorbidities. Stability or instability, embolus size and size of occlusion of pulmonary artery are factors that determine state of patient, but do not determine risk of death. Chronic thromboemolic pulmonary hypertension (CTPH) is complication, which occurs in 0,5-1,5% cases. Although incidence of this complication is low, when CTPH occurs 5-year mortality rate is 20% . [11]

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