



ISSN (E): 2277- 7695  
 ISSN (P): 2349-8242  
 NAAS Rating: 5.03  
 TPI 2018; 7(10): 599-602  
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[www.thepharmajournal.com](http://www.thepharmajournal.com)  
 Received: 19-08-2018  
 Accepted: 20-09-2018

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## Pulmonary embolism in the therapeutic practice, risk assessment on the example of clinical case

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### Abstract

Pulmonary embolism (PE) is a “great imitator” and the symptoms of the disease are nonspecific, besides there is a lack of alertness of doctors and patients in terms of the development of this terrible complication. The aim of our work is to assess the risk of PE developing in patients of the therapeutic profile, to identify patients at high risk for determining direct sources of thrombosis and to analyze the most significant factors that can lead to errors in the diagnosis of PE on the example of a clinical case with an unfavorable outcome.

Totally 78 patients were examined. A study of hospitalized patients with a therapeutic profile using the Geneva and Wells scales revealed a high risk of PE in 6,4% of cases. In the high-risk group with the help of additional survey methods, there was a direct threat of PE development and in two cases PE of small branches was confirmed.

Analyzing one clinical case it is worth to remark such reasons for the late diagnosis of PE and an unfavorable outcome as acute leg injury and the presence of DVT, low compliance with the patient, lack of alertness in PE development during hospitalization, unpredictable case anamnesis, reassessment of additional studies (CT) conclusion, late appointment of methods for diagnosing of the localization and massiveness of PE.

**Keywords:** Pulmonary embolism, differential diagnosis, the Geneva and wells scales

### Introduction

Nowadays pulmonary thromboembolism (PE) is one of the most common cardiovascular pathologies and averages from 0.5 to 2 cases per 1000 per year <sup>[5]</sup>. The incidence of PE is between 23 and 250 cases per 100000 per year, but every second case is not diagnosed <sup>[3]</sup>. This is due primarily to the fact that PE is a “great imitator” and the symptoms of the disease are nonspecific, besides there is a lack of alertness of doctors and patients in terms of the development of this terrible complication. PE is the second most common cause of sudden death <sup>[6]</sup>. In recent years mortality from PE has increased significantly and amounts 117 cases per 100000. Moreover, in 70% of cases the diagnosis of PE has been already put posthumously <sup>[7]</sup>.

The main predisposing factors for the development of PE are thrombosis of the deep veins of the lower extremities, but in therapeutic practice this often remains beyond the attention of the physician. However, it should be remembered that such clinical manifestations as central venous catheterization, chronic cardiac and respiratory insufficiency, sepsis, malignant neoplasms, chemo- and hormone therapy, thrombophilia are among the factors of moderate risk, and pregnancy, postpartum status, advanced age, obesity, varicose veins, prolonged bed rest (more than 3 days) and prolonged sitting position are factors of low risk <sup>[4]</sup>.

Modern laboratory tests allow to identify hereditary factors of PE development: resistance to activated protein C (the presence of this mutation increases the probability of occurrence of deep vein thrombosis in 3 times); mutation of 20210A prothrombin (the probability of developing deep vein thrombosis or PE increases by 2 times) <sup>[2]</sup>.

The aim of our work is to assess the risk of PE developing in patients of the therapeutic profile, to identify patients at high risk for determining direct sources of thrombosis and to analyze the most significant factors that can lead to errors in the diagnosis of PE on the example of a clinical case with an unfavorable outcome.

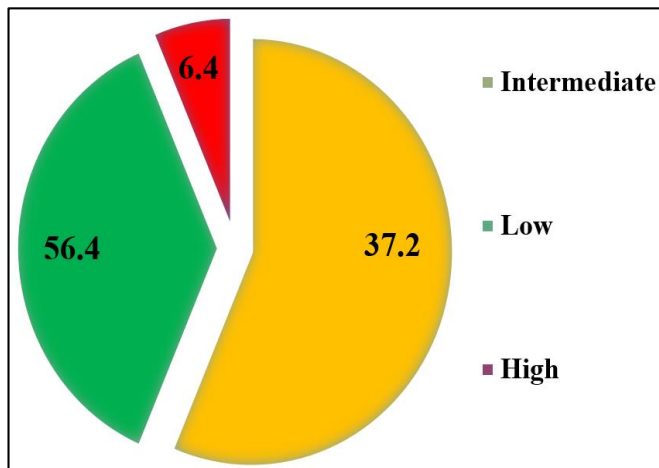
The work was carried out in the therapeutic, pulmonological and cardiological departments of the city clinical hospital. Standard clinical examination methods, laboratory tests: general blood test, coagulogram, renal and liver tests were done for patients. A modified Geneva scale <sup>[9]</sup> and a Wells scale <sup>[11]</sup> with a three-level probability assessment scheme were used to

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assess the risk of PE. Since the use of the Geneva scale made it possible to identify intermediate and high degrees of probability in a larger number of patients, it is important to focus on its results.

Totally 78 patients were examined: 37 men (47%) and 41 women (53%). From them 25 patients (32%) have cardiovascular diseases, 20 patients (25%) have bronchopulmonary system, 4 patients (5%) with oncological pathology, 2 patients (3%) with liver diseases, 27 patients (35%) had several comorbid pathology.

According to the scales, most patients had intermediate risk of PE (Graph. 1).



**Graph 1:** PE risk distribution in hospitalized patients according to Geneva and Wells scale.

In the group with a high probability of PE developing (5 patients), women (3 person) predominated; cardiovascular diseases dominated (4 person). Additional examination of the lower extremities vessels revealed thrombosis of the deep veins in 3 patients, which was 60% among group of high PE risk. In 2 patients of this group the history and clinical signs allowed to suspect PE of the small branches, which was confirmed by an additional examination (computed tomography (CT) angiography, echocardiography (EchoCG), while the coagulogram was absolutely not informative.

Thus, a study of hospitalized patients with a therapeutic profile using the Geneva and Wells scales revealed a high risk of PE in 6.4% of cases. In the high-risk group with the help of additional survey methods, there was a direct threat of PE development and in two cases PE of small branches was confirmed.

However, the lack of clinical alertness can lead to late diagnosis and to adverse outcomes of the disease. On the example of the analysis of the clinical case on the basis of the pulmonology department, it is possible to identify the main factors that led to late diagnosis and irreversible consequences.

Patient M., 43 years old, complained of profuse hemoptysis, shortness of breath at minimal load, pain in the left half of the chest, subfebrile temperature. He connected the disease with a hypothermia on fishing 1,5 month ago, after which there was a sore throat and a rhinitis. Shortness of breath appeared a month ago, and three days ago sharply increased. X-ray revealed infiltrative changes on the left with destruction (Graph.2).



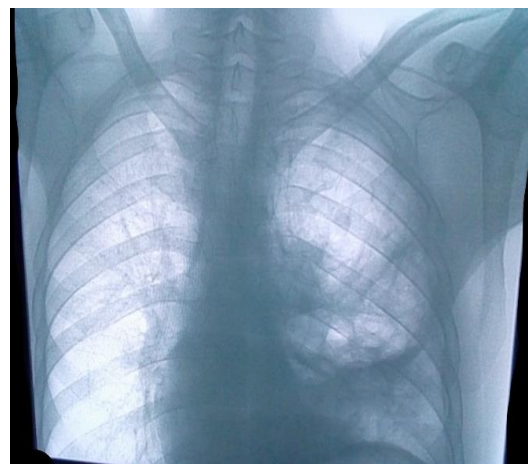
**Graph 2:** Frontal chest X-ray of the patient M. during hospitalization.

The left-sided destructive pneumonia was diagnosed, was intravenous antibacterial therapy (ceftriaxone + levofloxacin) was prescribed. But in 7 days patient had the negative clinical dynamics. Chest CT scan was performed, the conclusion of which was destructive pneumonia on the left.

The duration of the disease, sudden development of dyspnea, the presence of hemoptysis and chest pain, negative clinical dynamics and the absence of the effect of antibiotic therapy led to the need to differentiate the disease from PE. Correct collection of anamnesis in patients allows including PE in the list of neologies requiring differential diagnosis.

However the patient denied all possible causes of thrombosis. Clinical indices are distinguished by large polymorphism: dyspnea, tachypnea, chest pain, cough, hemoptysis, syncope, syndromes of deep venous thrombosis (DVT), cyanosis, tachycardia, fever (their specificity varies within 7-68%) [1]. The indicator of D-dimer level, although highly sensitive and fast in determination, but not specific, can only exclude PE (in the case of a concentration <0,5 mg/L of its level) [10].

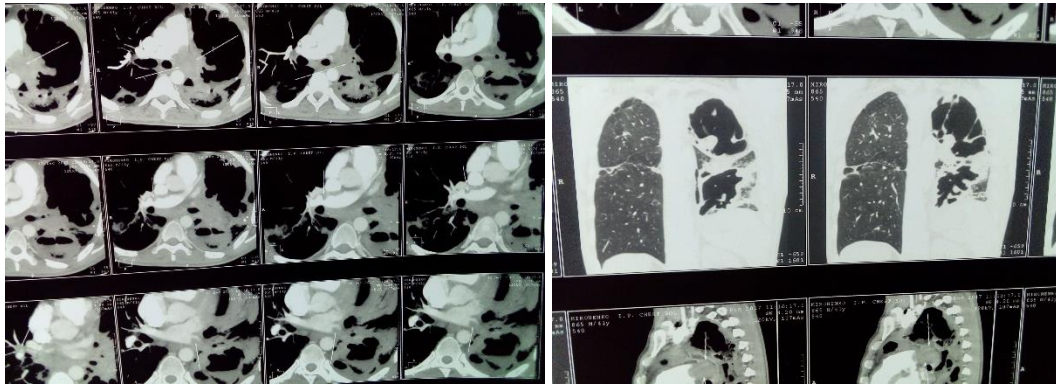
In this case the study of this marker was not appropriate because of profuse hemoptysis. Suddenly on the tenth day the patient's condition deteriorated seriously: blood pressure was 60/40 mm Hg, oxygen saturation was 78%, heart rate was 128 per min, breathing rate was 38 per min. The patient was transferred to the intensive care unit (ICU). Radiographically he had the negative dynamics (Graph. 3). There was a second suspicion of a possible PE (relapse).



**Graph 3:** Frontal chest X-ray of the patient M. on the 10<sup>th</sup> day after hospitalization.



In the acute stage of PE, electrocardiogram (ECG) and echoCG should be performed [8]. According to the ECG the patient had blockade of the posterior branch of the right leg of the fasciculus of the bundle, sinus tachycardia, negative T teeth in V<sub>1</sub>-V<sub>3</sub>, which indicated an overload of the right heart.



**Graph 4:** Chest CT-angiogram of the patient M. on the 12<sup>th</sup> day after hospitalization.

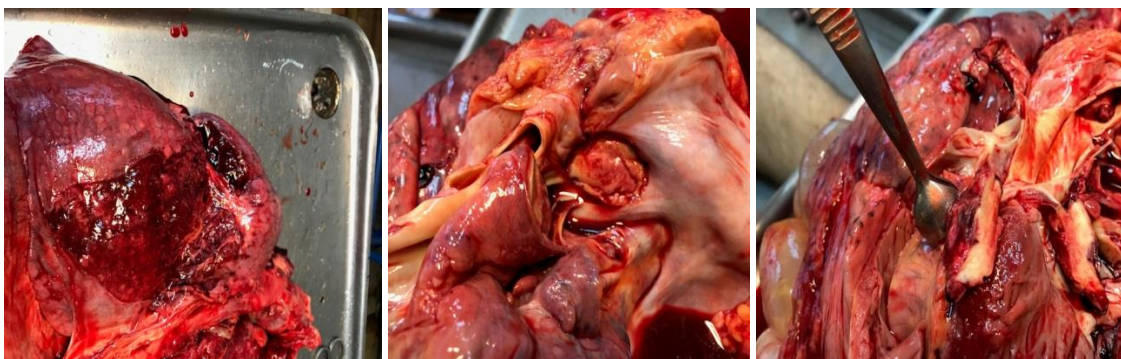
Multilayer angio-CT is a minimally invasive and relatively accessible method that allows confirming or excluding the diagnosis of PE [9]. In case of timely establishment of the correct diagnosis and prescribing of adequate therapy, it is possible to minimize the risk of death from PE to 8% [2]. The diagnosis of PE was put on the 12th day of hospitalization, when the prognosis for the patient's life was already unfavorable. After the diagnosis, the patient remembered a left leg injury 4 months before the first episode of shortness of breath. At that time the patient was consulted by a traumatologist, DVT of the left tibia was revealed, and doctor recommended compression stockings and long-term

With the purpose of excluding PE, a repeated chest CT with angiography was assigned: multiple defects of filling in the vessels of the right lung, almost complete absence of passage of the contrast in the pulmonary trunk, destruction of the parenchyma of the left lung were diagnosed (Graph. 4).

using of rivaroxaban 20 mg per day, but the patient did not perform this.

The patient died in the ICU in 2 weeks after hospitalization. There was a coincidence of clinical and pathological-anatomical diagnoses:

Recurrent PE, multiple right-sided infarct-pneumonia, thrombosis and complete occlusion of the left pulmonary artery (Graph. 5), secondary pulmonary hypertension, right ventricular hypertrophy, dilatation of the right ventricular and atrium, decay cavity with suppuration on the left side, lung and heart failure, hyperemia and hypertrophy of the liver, dystrophic changes in the kidneys.



**Graph 5:** Autopsy data of the lungs in patient M.

Analyzing this clinical case it is worth to remark such reasons for the late diagnosis of PE and an unfavorable outcome as acute leg injury and the presence of DVT, low compliance with the patient, lack of alertness in PE development during hospitalization, unpredictable case anamnesis, reassessment of additional studies (CT) conclusion, late appointment of methods for diagnosing of the localization and massiveness of PE.

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