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CASE STUDY: EVOLUTION OF A PATIENT WITH PULMONARY EMBOLISM

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ABSTRACT

Pulmonary embolism (PE) poses a significant health threat, with 350,000 annual cases in the United States, resulting in 100,000 deaths. PE arises from the obstruction of pulmonary arteries, typically by blood clots originating from deep veins. Risk factors mirror those of deep vein thrombosis, encompassing genetic and acquired factors. Timely diagnosis is imperative due to substantial mortality and morbidity rates, with various diagnostic modalities employed. Treatment options include anticoagulants, thrombolytics, surgical embolectomy, and inferior vena cava filters. We present a case from our orthopedics department, underscoring the importance of prompt diagnosis and intervention in managing PE. The case involved a 37-year-old male motorcyclist admitted post-trauma, who later developed acute dyspnea, leading to the diagnosis of high-risk PE. Thrombolysis with Actilyse was initiated, highlighting the critical role of rapid risk stratification and treatment initiation in mitigating PE-related morbidity and mortality.

Keywords: trauma, pulmonary embolism, treatment options, diagnostic

Introduction

In the United States, pulmonary embolism mainly affects adults, with approximately 350,000 cases reported each year, of which 100,000 have an unfavorable outcome, resulting in death. (1)

Pulmonary embolism (PE) represents the blockage of one of the pulmonary arteries in the lungs. In most cases, pulmonary embolism is caused by blood clots circulating to the lungs from the deep veins of the lower limbs or, rarely, from other areas of the body (deep vein thrombosis). (2)

Pulmonary embolism occurs when the blood flow in the pulmonary arteries is blocked by an embolus. Blood clots move upward through the right side of the heart, eventually reaching the lungs. (3)

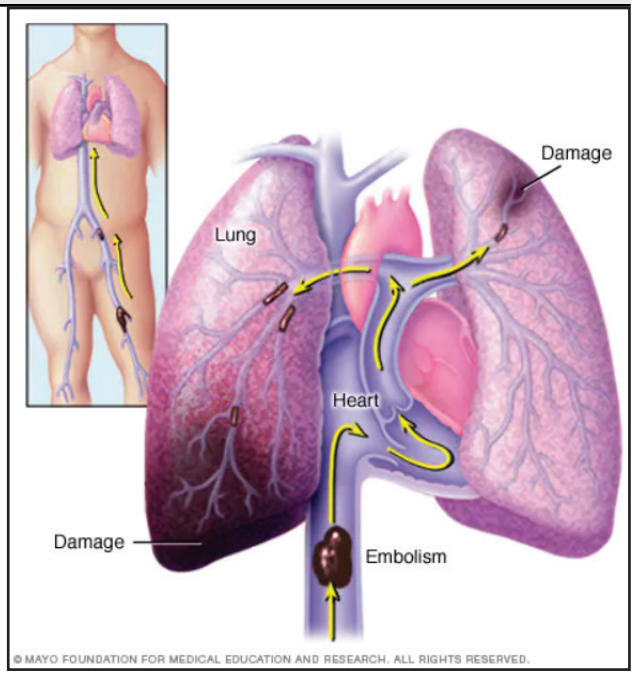

Figure 1 - Mechanism of pulmonary embolism

Risk factors for pulmonary embolism are the same as those for deep vein thrombosis. A better understanding of these factors can be provided by Virchow's triad: hypercoagulability, venous stasis, endothelial injury. (4)

Table 1 – Risk Factors for Pulmonary Embolism (5)

Risk factors	
Genetic factors	Aquired factors
Thrombophilia	Prolonged immobilization
Mutation of the factor V Leiden	Recent orthopedic surgery
Mutation of the prothrombin gene	Malignancy
Hiperhomocisteinemia	Permanent venous catheter
Protein C deficiency	Obesity
Protein S deficiency	pregnancy

It is crucial to precisely determine the type of pulmonary embolism based on the presence or absence of hemodynamic stability. Thus, hemodynamically stable pulmonary embolism can range from mild, asymptomatic, or symptomatic (low-risk PE) to PE causing mild arterial hypotension but stabilizing with fluid therapy (intermediate-risk PE). Hemodynamically unstable pulmonary embolism (high-risk PE) is represented by PE with systolic arterial hypotension (SBP <90mmHg) or a decrease in SBP by 40mmHg compared to the initial value or arterial hypotension requiring vasopressor or inotropic therapy. These high-risk PE patients are more likely to progress to death due to obstructive shock (severe right ventricular failure). (4)

Timely diagnosis of pulmonary embolism is crucial due to the high associated mortality and morbidity, which can be prevented with early treatment. It is noteworthy that approximately 30% of untreated patients die, while only 8% die after the initiation of timely therapy. (6)

The following investigations are conducted for the diagnosis of pulmonary embolism:

- Blood gas analysis
- Brain natriuretic peptide (BNP)
- Troponin
- D-dimers (8)
- Electrocardiography. The most common changes seen on EKG in patients with PE are tachycardia and nonspecific changes in the ST segment and T wave, the S1Q3T3 pattern (7)
- Chest X-ray: may be normal or may show some nonspecific changes: effusion or atelectasis (9)
- Computed tomographic pulmonary angiography (CTPA): is the method of choice for diagnosis (10)
- Pulmonary scintigraphy (11)
- Pulmonary angiography
- Echocardiography (12)

Before administering specific treatment, rapid risk stratification should be performed. Treatment options for pulmonary embolism may include the following: anticoagulants (13), thrombolytics (14), surgical embolectomy (15), inferior vena cava filters (16).

Case presentation: Presentation of a case from the case series of the Orthopedics and Traumatology Department of the County Clinical Emergency Hospital „St. Apostle Andrew" Galați, in 2019.

A 37-year-old male patient, of Roma ethnicity, a victim of a road accident (motorcyclist), is brought by the SMURD team

Table 2 - Classification of patients with acute PE based on the risk of early mortality

Risk of early death		Parameters and risk shocks			
		Shock or arterial hypertension	PESI class III-V or sPESI	Imagistic signs of RV dysfunction	Biomarkers
Risk	High risk	+	+	+	+
	Intermediate-high risk	-	+	Both +	
	Low intermediate risk	-	+	One +/Both -	
	Reduced risk	-	-	optional assessment: both -	

to the County Clinical Emergency Hospital „St. Apostle Andrew" Galați. The clinical examination highlights: preserved consciousness, GCS = 15 points, pale, sweaty skin, HR = 81bpm, BP = 100/60 mmHg, balanced cardio-respiratory, supple, depressible abdomen, no signs of meningeal irritation, swelling, and hematoma in the right thigh.

The paraclinical investigations carried out on the day of admission highlight:

Spine CT

- Native brain CT
- CT spine
- Native brain CT
- Femur X-ray: fracture in the upper 1/3 of the right femoral shaft
- Knee and leg X-ray: no pathological changes
- Cardio-pulmonary X-ray: accentuated diffuse pulmonary interstitium bilaterally. Enlarged transverse diameter of the heart.
- Negative SARS-CoV-2 RNA
- Hemogram: leukocytosis with neutrophilia, decreasing hemoglobin values but within normal limits
- Secondary hyperglycemia
- Hepatocellular syndrome
- Other analyses within normal limits

Following the investigations, a splenectomy is performed with a favorable evolution. At 5 days after admission, orthopedic intervention is performed, achieving reduction and osteosynthesis of the bifocal femur fracture with a long Gamma nail, with a good postoperative evolution

Throughout the hospitalization, laboratory analyses normalize, but leukocytosis with neutrophilia persists.

Figure 2 - Follow-up X-ray of the hip and femur

At 2 days postoperatively, the patient discharges upon request, contrary to medical advice, with the following recommendations:

- Mobilization within pain limits with a metal frame or crutches, avoiding support on the operated pelvic limb for an additional 2 months
- Rehabilitative physical therapy for the right hip and knee
- Continued thromboembolism prophylaxis with Clexane 0.6ml, 1 vial/day for an additional 20 days
- Suture removal 10 days after discharge
- Follow-up appointment in the specialized outpatient clinic in 2 months

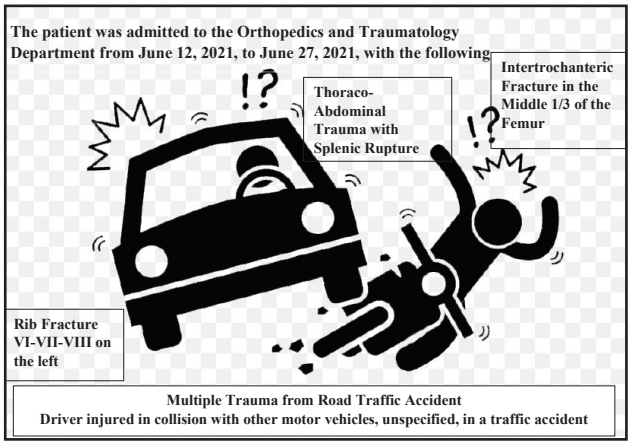

Figure 3 – Diagnoses at the time of discharge from the Orthopedics and Traumatology Department

Two weeks after discharge, the patient presents to the Emergency Department with suddenly onset dyspnea, cyanotic skin, profuse sweating, HR=120 bpm, BP=80/50 mmHg, SpO2=81% in room air. The following tests are performed:

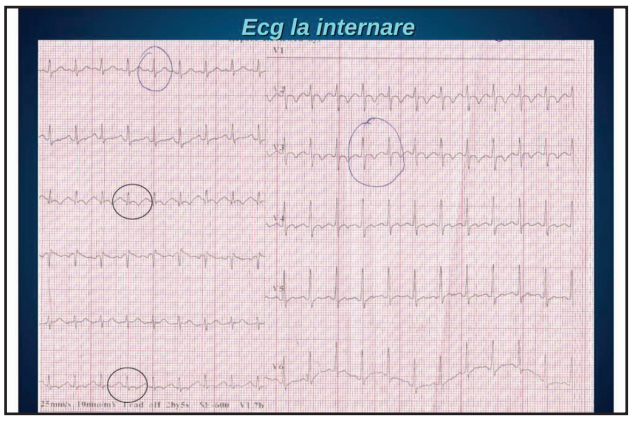

Figure 4 – EKG performed at the time of admission - EKG: Sinus tachycardia, S1Q3T3

Echocardiography: pulmonary hypertension, dilated right ventricle, collapsed left ventricle due to the interventricular septum

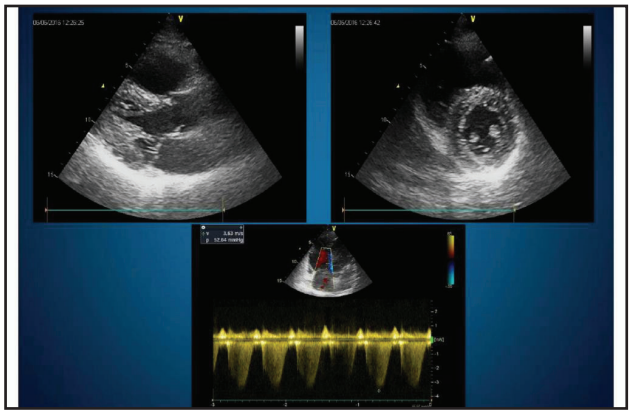

Figure 5 – Echocardiogram performed at the time of admission

As a result of the clinical and paraclinical examination, the diagnosis of pulmonary embolism is suspected, and a decision is made to perform a CT pulmonary angiography.

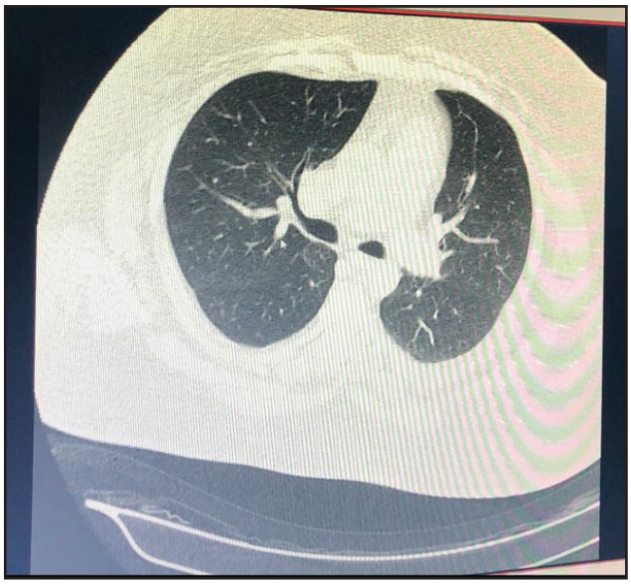

Figura 6 – AngioCT performed to confirm the diagnosis

Following the CT examination, the diagnosis of high-risk pulmonary embolism is established, and thrombolysis with Actilyse is performed.

After diagnosis and administration of thrombolysis, the patient does not show a favorable evolution and succumbs to the condition.

Discussion

According to a study conducted in Tokyo between 2010 and 2014, involving 1428 patients (795 females and 633 males), acute pulmonary embolism is more frequently encountered in older female patients, and they associate with a poor prognosis. (17) In our study, the patient was a 37-year-old male.

As observed, numerous risk factors can be involved in determining pulmonary embolism (genetic and acquired factors). Globally, over 50% of hospitalized patients are exposed to the risk of venous thrombosis, and surgical patients have a higher risk compared to medical patients. (18) A study conducted between January 2010 and December 2011, including 18,151 patients with acute trauma or elective orthopedic procedures, emphasized that only 85 of the admitted patients developed pulmonary embolism, with 24 undergoing surgery, and 61 suffering acute

trauma. (19) In our case, the patient underwent splenectomy, followed by the reduction and osteosynthesis of a bifocal femur fracture, with a favorable outcome.

The major symptom reported by most patients with pulmonary embolism is sudden-onset resting dyspnea, but it can also present as progressive effort-induced dyspnea. Additionally, patients may experience cough, hemoptysis, chest pain, and dyspnea. In severe cases, pulmonary embolism can lead to arterial hypotension, shock, or cardiac arrest. Isolated dyspnea with rapid progression occurs in the majority of cases in patients with extensive pulmonary embolism, causing significant hemodynamic impact. (20) In our case, the patient presented sudden-onset dyspnea associated with arterial hypotension (BP=80/50 mmHg) and a decrease in SpO2 to 81% in atmospheric air.

For the management of patients with acute pulmonary embolism, prognostic assessment is necessary. The instruments used for prognostic evaluation of PE are the Pulmonary Embolism Severity Index (PESI) and the simplified PESI (sPESI). (21) According to a meta-analysis involving 21 studies, the Pulmonary Embolism Severity Index (PESI) has discriminatory power to predict short-term mortality. The accuracy of both PESI and sPESI is similar, but sPESI is easier to use. (21) This was evident in our case, where the patient was diagnosed with high-risk pulmonary embolism, and subsequently, the outcome was unfavorable leading to exitus.

Case Specifics

Despite the higher incidence of pulmonary embolism in female patients, our study included a male patient.

The presented patient underwent splenectomy, followed by the reduction and osteosynthesis of a bifocal femur fracture. In accordance with the aforementioned study, he is one of the few patients who developed PE following acute trauma or surgical interventions.

At the initial admission, following two surgical interventions, the patient exhibited good postoperative evolution.

Unfavorable evolution in a relatively short time, approximately 2 weeks, with sudden-onset symptoms, despite favorable evolution at the previous discharge.

Following the installed symptoms (sudden dyspnea, profuse sweating, cyanotic skin, and arterial hypotension) and investigations, the patient was diagnosed with high-risk pulmonary embolism, with subsequent unfavorable evolution, ultimately leading to the patient's demise.

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