

# Percutaneous Intervention in Acute Pulmonary Embolism

Berkay Ekici, Murat Eren

Department of Cardiology, Faculty of Medicine, Ufuk University, Ankara, Turkey

## Abstract

Pulmonary thromboembolism (PTE) is usually caused by deep vein thrombosis (DVT) in the lower extremities; which can be as varied clinical spectrum as asymptomatic embolism detected incidentally to serious disease with massive embolism causing death. A 44 year-old female patient was admitted to emergency department with complaints of general condition impairment, hypotension and marked dyspnea. She had a fracture on the right femur proximal region after falling a month ago. Lower extremity Doppler ultrasonography revealed findings consistent with acute deep vein thrombosis in the right lower extremity. Emergency pulmonary CT angiography revealed bilateral massive pulmonary thromboembolism extending especially from the main pulmonary artery to the right pulmonary artery. IV thrombolytic was contraindicated as a result of head trauma and subdural hematoma history a month ago. The patient was taken to the catheter laboratory and we performed a selective thrombus aspiration and fragmentation. The vital signs and hemodynamics of the patient improved rapidly after the procedure. This case report is important for demonstrating rapid percutaneous management of a young female patient with a life-threatening condition and favourable outcome of percutaneous intervention despite many comorbid conditions.

**Keywords:** Percutaneous treatment, pulmonary thromboembolism, thrombectomy

## INTRODUCTION

Pulmonary thromboembolism (PTE) is usually caused by deep vein thrombosis (DVT) in the lower extremities, which can be as varied clinical spectrum as asymptomatic embolism detected incidentally to serious disease with massive embolism causing death. Chronic thromboembolic pulmonary hypertension (CTEPH) is the chronic sequelae of the disease. The Virchow triad, which consists of local intimal damage to the vessel wall, hypercoagulability, and blood stasis, causes thrombus formation in the lower extremity, pelvis, or upper extremities' venules may cause embolism in pulmonary arteries. The most common source of pulmonary embolism is deep venules in the lower extremities and iliac veins.<sup>[1,2]</sup> In this case, we presented a percutaneous treatment of a patient with massive acute PTE.

## CASE REPORT

The patient who was then learned to have the right lower extremity splinted because of a fracture on the right femur proximal region after falling a month ago was admitted to emergency department with complaints of general condition impairment, hypotension, and marked dyspnea. The patient's

initial systolic blood pressure was 65 mmHg, and diastolic pressures could not be measured. On physical examination, radial pulse was palpated as filiform. In cardiac auscultation, S1-S2 was detected as rhythmic and tachycardic (120/min). Respiratory sounds were found bilaterally decreased. The patient's electrocardiogram showed sinus tachycardia and S1-Q3-T3 pattern. Arterial blood gas was detected as pH: 7.50, PCO<sub>2</sub>: 25 mmHg, and PO<sub>2</sub>: 65 mmHg. D-dimer value was 668 ng/ml and was found to be elevated. Troponin-I level was also elevated (313.2 pg/mL). Lower extremity Doppler ultrasonography revealed findings consistent with acute DVT in the right lower extremity. Emergency pulmonary computed tomography (CT) angiography revealed bilateral massive PTE extending especially from the main pulmonary artery to the right pulmonary artery [Figure 1]. The patient was referred to the chest diseases' consultation and reported that she could not get intravenous (IV) thrombolysis because of subdural hematoma history following the fall 1 month ago. After rapid progression of hemodynamic

**Address for correspondence:** Assoc. Prof. Berkay Ekici,  
Department of Cardiology, Faculty of Medicine,  
Ufuk University, Ankara, Turkey.  
E-mail: berkay.ekici@gmail.com

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instability, the decision was made to manage the patient percutaneously in the cardiovascular surgery and cardiology council. The patient was taken to the catheter laboratory because of hemodynamic instability with acute massive PTE, and under the local anesthesia, the right femoral vein was cannulated using the Seldinger method. The main pulmonary artery was reached through the vena cava inferior, right atrium, and right ventricle. On pulmonary angiography, massive PTE was observed in the main and right–left pulmonary arteries compatible with CT [Figure 2]. The 0.038” hydrophilic guidewire first passed through the right pulmonary artery, then through the left pulmonary artery. We performed a selective thrombus aspiration from the main, right, and left pulmonary artery with thrombus aspiration catheter. However, because of the intense thrombus load, the thrombus was fragmented with the Cleaner rotational thrombectomy system on the launcher 8F guiding catheter, followed by selective thrombus aspiration to the right and left PAs and branches [Figure 3a & b]. The operation was repeated three times to get an optimal result. Although IV thrombolytic was contraindicated as a result of head trauma and subdural hematoma history a month ago, 15 cc thrombolytic was selectively administered into the pulmonary

artery due to the continuation of hypotension and general condition impairment. The vital signs and hemodynamics of the patient improved rapidly after the procedure. Control pulmonary CT angiography taken 5 days after admission to the Coronary Intensive Care Unit showed complete resorption of thrombus material in the main pulmonary artery and its branches [Figure 4a and b]. The patient was discharged with rivaroxaban scheduled to start at 15 mg 2 × 1 dose for 3 weeks followed by 20 mg 1 × 1 oral daily dose. No problems were observed during the 1<sup>st</sup>, 6<sup>th</sup>, and 12<sup>th</sup> months’ controls.

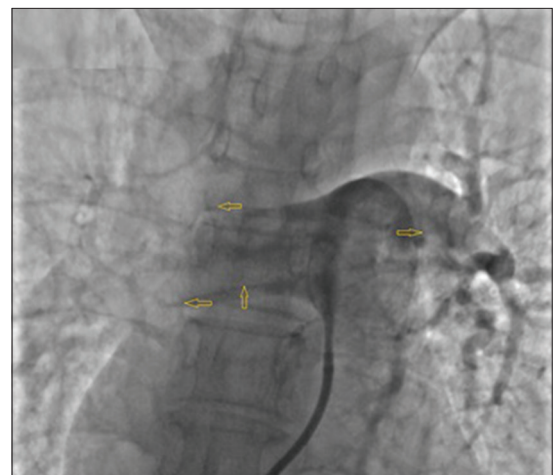
## DISCUSSION

PTE is a clinical condition with high mortality rates that should always be considered as a possible diagnosis. PTE shows a wide spectrum of manifestations clinically. In the old sources, this distribution was in the form of massive, submassive, and nonmassive according to clinical severity. Serious hypotension, cardiogenic shock, or acute right ventricular failure associated with cardiopulmonary arrest may develop in the massive pulmonary embolism.

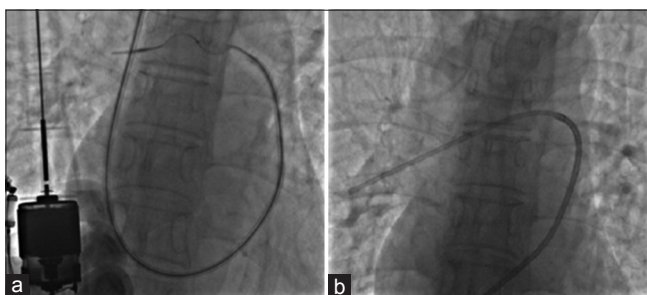
Deterioration and dilatation of the right ventricular free wall movement in transthoracic echocardiography against normal systemic blood pressure can be detected in submassive



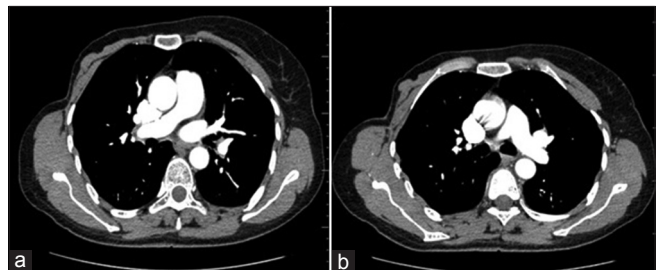
**Figure 1:** Cross-sectional image of pulmonary computed tomography angiography compatible with marked thromboembolism in the right and left pulmonary arteries



**Figure 2:** Pulmonary angiography showed marked thromboembolic images (arrows) in both pulmonary arteries and branches, especially in the right main pulmonary artery



**Figure 3:** (a) Performing thrombus fragmentation with cleaner rotational thrombectomy system, (b) selective thrombus aspiration to pulmonary artery and branches



**Figure 4:** (a and b) On the 5<sup>th</sup> day of treatment, control pulmonary computed tomography angiography showed complete resorption of thrombus materials in the main pulmonary artery and its branches

pulmonary embolism. In the nonmassive pulmonary embolism, systemic blood pressure and right ventricular function are normal.<sup>[3]</sup> The severity of PTE is considered according to the level of risk of premature mortality associated with PTE rather than the distribution, shape, and burden of intrapulmonary embolism. Therefore, current guidelines recommend that the estimation of the early mortality risk associated with PTE should be used instead of misleading terms such as “massive,” “submassive,” and “nonmassive”. According to this, if the clinical condition is accompanied by shock and hypotension, high-risk PTE is mentioned, while it is referred to as nonhigh-risk PTE if it is not.<sup>[4]</sup> Mortality in mild pulmonary embolism is <5% in 3–6 months under anticoagulant treatment. The rate of recurrence of the disease is below 5%. However, the risk of recurrence of a 10-year pulmonary embolism is 30%.<sup>[5]</sup>

ECG is a parameter that shows the electrical activity of the heart. Common findings in ECG in PTE patients are nonspecific ST/T wave changes and sinus tachycardia. However, a normal ECG is the most common finding. Rarely, ST segment elevation can also be observed. The classic S1-Q3-T3 pattern found also in our case is observed in only 20% of patients. It is not diagnostic, although it may suggest the possibility of PTE.<sup>[6]</sup>

We believe that the immobilization of the patient due to the fracture in the right femur is the leading cause for the DVT, which is thought to be the cause of PTE. In the literature, it has been found that patients who have DVT in the lower extremity with Doppler ultrasonography are not always correspond with deep venous thrombosis in physical examinations.<sup>[7]</sup> Having physical examination findings in the lower extremities is not a precondition for DVT diagnosis.

Mechanical thrombectomy catheters generally work on four different operating principles. These are

- a. Contact devices on the vessel wall: Arrow percutaneous thrombectomy device (PTD, Arrow International, Reading, PA, USA), Cleaner (Rex Medical, Fort Worth, TX, USA), etc.
- b. Hydrodynamic thrombectomy devices: Amplatz thrombectomy device (ATD/Helix, Microvena, White Bear Lake, MN, USA), Rotarex catheter (Straub Medical, Wangs, Switzerland), etc.
- c. Rheolytic (Flow-Based) thrombectomy devices: AngioJet (Possis Medical, Minneapolis, MN, USA), Oasis (Boston Scientific, Watertown, MA, USA), etc.
- d. Combination infusion catheter/isolated oscillation devices: Trellis Reserve (Bacchus Vascular, Santa Clara, CA, USA).<sup>[8]</sup>

We had aspiration with thrombus aspiration catheter first because of the presence of severe thrombus material in the main pulmonary artery and in the proximal parts of the right and left pulmonary artery and then underwent thrombus fragmentation with a Cleaner rotating thrombectomy device rotating at 4000 rpm and then aspiration was done again. In such high-risk PTE cases, percutaneous thrombectomy may be lifesaving because of providing rapid hemodynamic

improvement due to performing thrombus fragmentation and concomitant pulmonary arterial thrombolytic infusion

One of the subclasses of pulmonary hypertension, CTEPH, is a disease with high mortality and morbidity, resulting from massive, recurrent, and/or organized thrombi or vessel wall remodeling blocking pulmonary vessels and slowing blood flow. In this disease, pulmonary vascular resistance increases, pulmonary artery pressure rises, disease progressively worsens, and results right heart failure and death. In the ESC 2015 pulmonary hypertension guidelines, pulmonary endarterectomy (PEA) is recommended as Class I, level of evidence C in the treatment of CTEPH; riociguat, which is a soluble guanylate cyclase stimulator, is recommended as Class I level of evidence B in case of persistent or nonspecific symptomatic CTEPH clinic after PEA. In our patient, CTEPH clinic was not observed in follow-up because of long-term effective anticoagulation with early intervention.<sup>[4]</sup>

In conclusion, PTE is a health problem that can be lead to significant mortality and morbidity and the possibility of clinical diagnosis should always be kept in mind. In the treatment of this clinical entity, technics and devices are improving day by day in percutaneous interventions' era. This case report is important for demonstrating rapid percutaneous management of a young female patient with a life-threatening condition and favorable outcome of percutaneous intervention despite many comorbid conditions.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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