

Pulmonary Embolism in High-Risk Patients: How to Select Standard Imaging and Management Strategy?

Sidhi Laksono,^{1,2} Firizkita Dewi,¹ Reynaldo Halomoan³

¹Department of Cardiology and Vascular Medicine, Pertamina Central Hospital, South Jakarta, Indonesia,

²Faculty of Medicine Universitas Muhammadiyah Prof. Dr. Hamka, Tangerang, Indonesia,

³Faculty of Medicine Universitas Katolik Indonesia Atma Jaya, Jakarta, Indonesia

Abstract

Objective: To describe the use of computed tomography pulmonary angiography (CTPA) for diagnostic purposes and percutaneous catheter-directed thrombolysis (PCDT) as a treatment choice for high-risk pulmonary embolism (PE) patients.

Methods: This case report describes a case of an elderly female presented with dyspnea, cough, fever, and chest pain. No significant medical history was identified.

Results: CTPA was conducted and showed multiple thrombus with significant stenosis in several branches of pulmonary artery. Initial anticoagulation was administered without delay. Patient then underwent PCDT to remove the thrombus. No post intervention symptom and systemic complications were noted.

Conclusions: Computed tomography pulmonary angiography is useful as the standard imaging modality to help evaluating suspected pulmonary embolism. Percutaneous catheter-directed thrombolysis is indicated to treat high-risk patients with high risk of bleeding.

Keywords: Computed tomography pulmonary angiography, elderly people, high-risk pulmonary embolism, pulmonary embolism, treatment

pISSN: 2302-1381;
eISSN: 2338-4506;
<http://doi.org/10.15850/ijih.v9n1.2142>
IJHS. 2021;9(1):30-35

Received:
September 21, 2020

Accepted:
March 30, 2021

Introduction

Pulmonary embolism (PE) is a life-threatening thromboembolic event.¹ The incidence of PE has been growing and has reached the rate of 65 cases in 100.000 population.² Patients may experience various unspecific symptoms. Acute dyspnea is the most common symptom in PE. Chest pain is commonly associated with coronary events, but patients with pulmonary embolism may also experience chest pain with elevated levels of troponin. Unspecific symptoms such as fever may also appear although fever has no impact on disease severity

or prognosis.^{3,4} The clinical condition could go from low risk to high-risk with complications. Therefore, early diagnosis is important to determine the treatment strategy and prevent the mortality of the patient.⁵ Imaging modality could be useful to help establish the diagnosis. Various imaging modalities are available for evaluation of PE includes chest radiographs, echocardiography, computed tomography (CT) pulmonary angiography (CTPA), CT venography, magnetic resonance (MR) pulmonary angiography (MRPA), and ventilation/perfusion scan. Each modality has their own characteristics and diagnostic role.⁶ The purpose of this article is to describe the use of CTPA as the standard imaging modality to help establish the diagnosis of pulmonary embolism and its treatment based on patient's clinical condition.

Correspondence:

Sidhi Laksono Purwowiyoto,
Faculty of Medicine Universitas Muhammadiyah Prof. Dr. Hamka, Tangerang, Indonesia
e-mail: sidhilaksono@uhamka.ac.id

Case

The case describes A 70-years-old female who was admitted to our hospital due to dyspnea since 7 days before admission and became worsen, accompanied by cough, intermittent fever, and chest pain after 3 days since the initial onset of dyspnea. The patient was ill with GCS E4V5M6. The diagnosis of pleuropneumonia was made at the beginning with pulmonary embolism as a differential diagnosis, supported by infiltrates appearance in chest computerized tomography (CT) scan. There were not any significant past medical history. The physical examination showed rhonchi in both lungs and the cor was normal. Our patient then had a cardiac arrest and we conducted cardiopulmonary resuscitation (CPR). The rhythm was shockable and we shocked the patient. The return of spontaneous circulation (ROSC) was achieved. Due to the suspicion of PE, we administered enoxaparin. After the international normalized ratio (INR) had been achieved, we also administered warfarin.

Electrocardiography (ECG) and laboratory tests were done. The ECG (Fig. 1) showed a deep S wave in lead I, Q wave in lead III, and an inverted T wave in III. T-wave inversions in precordial leads also appeared. The blood cell count was normal, arterial blood pH was 7.39, pO_2 250 mmHg, pCO_2 30 mmHg, HCO_3

18 mEq/L, and base excess was -5 mEq/L. Another laboratory test showed an increased high-sensitivity troponin T (39.79 ng/L) and NT-proBNP (11178 pg/mL).

The patient then underwent a computerized tomography pulmonary angiography procedure. The CT showed thrombus in the right pulmonary artery truncus, anterior truncus of the right pulmonary artery, and right interlobar pulmonary artery (Fig. 2 and Fig. 3). Thrombus was also shown in the left interlobular pulmonary artery (Fig. 4). There were also significant stenosis in the right pulmonary artery truncus, right pulmonary artery anterior truncus, and left interlobular pulmonary artery (Fig. 2-Fig. 4).

The patient was given systemic thrombolysis and underwent a percutaneous catheter-directed thrombolysis (PCDT) procedure, and the symptoms had improved (Fig. 5). Consent was given to the patient for this procedure and case report publication.

Discussion

Pulmonary embolism is a condition that occurs because of a blood clot that travels to the pulmonary vessel. PE could be misdiagnosed at the beginning because the other diseases can mimic the symptoms of PE in the elderly.⁷ PE is the most common type of cardiovascular

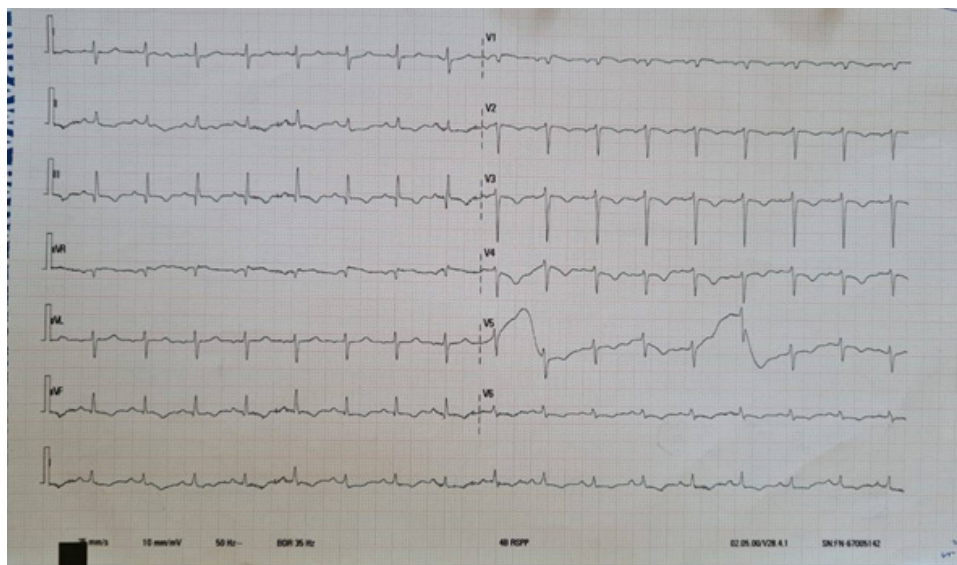


Fig. 1 ECG of the Patient Showed S1Q3T3 (S wave in lead I, W Wave and Inverted T Wave in lead III) Pattern and T-inverted Waves in Precordial Leads

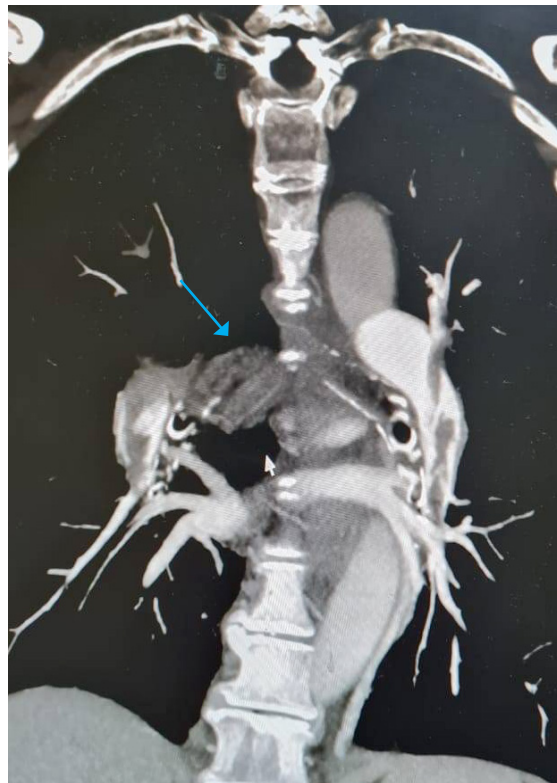


Fig. 2 Thrombus in Right Pulmonary Artery Truncus with Significant Stenosis (Blue Arrow)

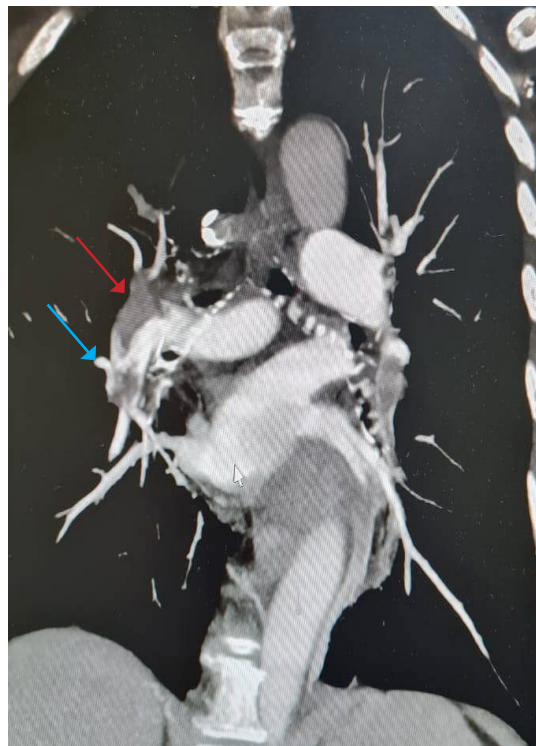


Fig. 3 Thrombus in Right Interlobar Pulmonary Artery (Blue Arrow) and Anterior Truncus of Right Pulmonary Artery with Significant Stenosis (Red Arrow)

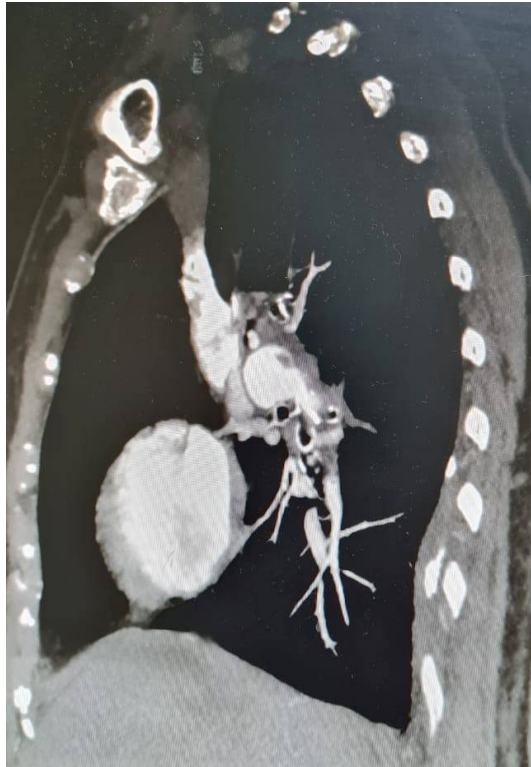


Fig. 4 Thrombus in Left Interlobular Artery at Posterior Basal Segment with Significant Stenosis (blue arrow)

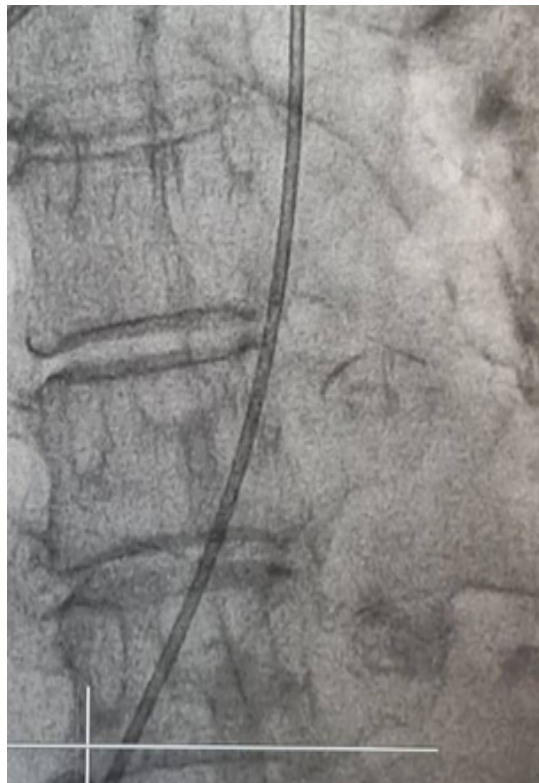


Fig. 5 Percutaneous Catheter-Directed Thrombolysis Procedure in Our Patient

disease after coronary artery disease and stroke. The obstruction in the pulmonary vessels could manifest in right ventricular failure. Thus, early diagnosis is very important because PE could cause sudden death within 2 hours after presentation, and also associated with a quite high mortality rate, 30% if it is not treated.⁸ Several risk factors could make someone more susceptible to experience PE, such as older age (>60 years old), history of venous thromboembolism events, trauma, previous major surgery, malignancy, coagulation disorders, and hormonal therapy.⁹

The most common symptoms that patients may experience are dyspnea (~92% of all patients with PE), pleuritic chest pain (49%), and also cough (20%). The symptoms occur due to disruption in pulmonary circulation, increased pulmonary arterial pressure, and disturbance in coronary circulation.^{10,11} In this case, our patient presented with several common symptoms of PE with older age as the only known risk factor. Our patient also experienced a fever. A study explained that fever (38°C -38.5°C) may present in pulmonary embolism and is associated with higher morbidity and clot burden. The mechanism of fever in PE is still unknown but may be related to inflammation cascade due to vascular irritation, tissue injury, or atelectasis.¹²

Clinical signs that refer to PE should be assessed to establish the diagnosis of PE. CTPA is the standard imaging modality with high sensitivity and specificity. The finding in CTPA are filling defects (gray) in pulmonary arteries (white). CTPA may be contraindicated in patients with kidney disease, pregnancy, or allergy to contrast. Patients who are contraindicated to undergo CTPA may undergo ventilation/perfusion lung scanning.¹³

Risk stratification is essential to do because it will determine the treatment strategy. The presence of shock, right ventricular dysfunction, and biomarkers elevation are signs of high-risk PE.⁶ The patient had a cardiac arrest suggesting the presence of shock. The ECG of our patient showed the S1Q3T3 pattern (acute right ventricle dysfunction).¹⁴ Further evaluation of RV function can be done by echocardiography. Some echocardiography

findings in PE are RV hypokinesis/dilatation, RV/LV ratio end-diastolic diameter >1, RV end-diastolic diameter >30 mm, D-sign (ventricular septum pushed towards the LV), increased pressure of pulmonary artery, and inferior vena cava dilatation.^{15,16}

This study also conducted laboratory tests to determine the NT-proBNP and Troponin T levels in our patient. The result showed the elevation of both biomarkers. Elevation of these biomarkers could show right ventricular dysfunction and have roles in risk stratification and prognostic indicators in PE cases.¹⁷

Management of pulmonary embolism is based on the severity of the disease. Our patient was classified into high-risk PE. The management of high-risk PE should be started with anticoagulant administration without delay, even while waiting for another diagnostic test result. We administered enoxaparin (LMWH) to our patient as the initial anticoagulant. LMWH was chosen instead of UFH because it carried a reduced risk of major bleeding and heparin-induced thrombocytopenia.¹⁸ High-risk PE is an absolute indication for thrombolytic treatment. Thrombolysis is beneficial in patients with the onset of symptoms range for 6-14 days and it can significantly reduce the mortality and recurrence of PE in the high-risk patients. Thrombolytic therapy can be done by administering systemic thrombolysis or by using catheter-directed thrombolysis (CDT). While systemic thrombolysis is effective as a treatment, it is also associated with a higher risk of severe bleeding (9.9%). Thus, CDT can be done as an alternative treatment in patient who has a high risk of bleeding, such as an elderly patient. CDT is also indicated in a patient with a shock that can cause death, before systemic thrombolysis has its effect.^{19,20} In conclusion, the risk of experiencing PE is increased in the elderly. Proper diagnosis and treatment could prevent mortality. CTPA is useful to help make the diagnosis in suspected PE patient, so the clinician could determine the treatment strategy. PCDT is indicated in high-risk PE patient with a life-threatening condition that needs prompt treatment.

References

1. Badireddy M, Mudipalli VR. Deep venous thrombosis (DVT) prophylaxis. Treasure Island (FL): StatPearls Publishing LLC; 2020.
2. Smith SB, Geske JB, Kathuria P, Cuttica M, Schimmel DR, Courtney DM, et al. Analysis of national trends in admissions for pulmonary

- embolism. *Chest*. 2016;150(01):35–45.
3. Tarbox AK, Swaroop M. Pulmonary embolism. *Int J Crit Illn Inj Sci*. 2013; 3(1):69–72.
 4. Ashorobi D, Ameer MA, Fernandez R. *Thrombosis*. Treasure Island (FL): StatPearls Publishing LLC; 2020.
 5. Jaff MR, McMurtry MS, Archer SL, Cushman M, Goldenberg N, Goldhaber SZ, et al. Management of massive and submassive pulmonary embolism, iliofemoral deep vein thrombosis, and chronic thromboembolic pulmonary hypertension: a scientific statement from the American Heart Association. *Circulation*. 2011;123(16):1788–830.
 6. Moore AJ, Wachsmann J, Chamarthy MR, Panjikaran L, Tanabe Y, Rajiah P. Imaging of acute pulmonary embolism: an update. *Cardiovasc Diagn Ther*. 2018; 8(3):225–43.
 7. Yayan J. Relative risk of pulmonary embolism in the very elderly compared with the elderly. *Clin Interv Aging*. 2013;8: 861–70.
 8. Bělohlávek J, Dytrych V, Linhart A. Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism. *Exp Clin Cardiol*. 2013;18(2): 129–38.
 9. Turetz M, Sideris AT, Friedman OA, Tripathi N, Horowitz JM. Epidemiology, pathophysiology, and natural history of pulmonary embolism. *Semin Intervent Radiol*. 2018;35(2):92–8.
 10. Sanchez O, Caumont-Prim A, Riant E, Plantier L, Dres M, Louis B, et al. Pathophysiology of dyspnoea in acute pulmonary embolism: A cross-sectional evaluation. *Respirology*. 2017;22(4):771–7.
 11. Morrone D, Morrone V. Acute pulmonary embolism: focus on the clinical picture. *Korean Circ J*. 2018;48(5):365–81.
 12. Saad M, Shaikh DH, Mantri N, Alemam A, Zhang A, Adrish M. Fever is associated with higher morbidity and clot burden in patients with acute pulmonary embolism. *BMJ Open Respir Res*. 2018;5(1):e000327.
 13. Corrigan D, Prucnal C, Kabrhel C. Pulmonary embolism: the diagnosis, risk-stratification, treatment and disposition of emergency department patients. *Clin Exp Emerg Med*. 2016;3(3):117–25.
 14. Duru S, Keleşoğlu A, Ardiç S. Clinical update on pulmonary embolism. *Arch Med Sci*. 2014;10(3):557–65.
 15. Mediratta A, Addetia K, Medvedofsky D, Gomberg-Maitland M, Mor-Avi V, Lang RM. Echocardiographic diagnosis of acute pulmonary embolism in patients with mcconnell's sign. *Echocardiography*. 2016;33(5):696–702.
 16. Vyas V, Goyal A. *Acute pulmonary embolism*. Treasure Island (FL): StatPearls Publishing LLC; 2020.
 17. Lankeit M, Jiménez D, Kostrubiec M, Dellas C, Kuhnert K, Hasenfub G, et al. Validation of n-terminal pro-brain natriuretic peptide cut-off values for risk stratification of pulmonary embolism. *Eur Respir J*. 2014;43(6):1669–677.
 18. Cossette B, Pelletier ME, Carrier N, Turgeon M, Lecalir C, Charron P, et al. Evaluation of bleeding risk in patients exposed to therapeutic unfractionated or low-molecular-weight heparin: a cohort study in the context of a quality improvement initiative. *Ann Pharmacother*. 2010;44(6): 994–1002.
 19. Konstantinides SV, Meyer G, Becattini C, Bueno H, Geersing GJ, Harjola VP, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J*. 2020;41(4):543–603.
 20. Brown KN, Devarapally SR, Lee L, Gupta N. *Catheter directed thrombolysis of pulmonary embolism*. Treasure Island (FL): StatPearls Publishing LLC; 2020.