

Role of transesophageal echocardiography in a patient with an initially misdiagnosed acute pulmonary embolism: a case report

Mohamed Aziz Daghmouri¹, Maroua Oueslati ², Mohamed Amine Tarhouni ², Sameh Zakhama ², Olfa Faten², and Lotfi Rebai³

¹Charles Nicolle Hospital

²Centre de Traumatologie et des Grands Brules

³University of Tunis El Manar Faculty of Medicine of Tunis

March 2, 2021

Abstract

Chest CT angiography is considered as the gold standard for the diagnosis of acute pulmonary embolism. However, echocardiography could be useful especially in cases of high suspicion with normal CT scan or for patient with hemodynamic instability.

Title page

Title: Role of transesophageal echocardiography in a patient with an initially misdiagnosed acute pulmonary embolism: a case report

Author:

- Mohamed Aziz Daghmouri (Department of Anesthesia, Trauma Center of Ben Arrous)
- Maroua Oueslati (Department of Anesthesia, Trauma Center of Ben Arrous)
- Mohamed Amine Tarhouni (Department of Anesthesia, Trauma Center of Ben Arrous)
- Olfa Faten (Department of Anesthesia, Trauma Center of Ben Arrous)
- Sameh Zakhama (Department of Anesthesia, Trauma Center of Ben Arrous)
- Lotfi Rebai (Department of Anesthesia, Trauma Center of Ben Arrous)

Corresponding author:

Mohamed Aziz Daghmouri

Mail: aziz.daghmouri@gmail.com

Phone : 00216 29 442 474

Financial Disclosures:

None

Conflicts of interest:

None

Word count:

Abstract: 205

Entire body: 2165

Author's contribution:

- Mohamed Aziz Daghmouri: This author helped in making the diagnostic, taking care of the patient and writing the first draft
- Maroua Ouesleti: This author helped in making the diagnostic and taking care of the patient
- Mohamed Amine Tarhouni: This author helped in making the diagnostic and taking care of the patient
- Olfa Faten: This author helped in making the diagnostic and taking care of the patient
- Sameh Zakhama: This author helped in taking care of the patient
- Lotfi Rebai: This author helped in the revision of the manuscript

Role of transesophageal echocardiography in a patient with an initially misdiagnosed acute pulmonary embolism: a case report

Abstract:

Background:

Chest CT angiography is considered as the gold standard for the diagnosis of acute pulmonary embolism. However, echocardiography could be useful especially in cases of high suspicion with normal CT scan or for patient with hemodynamic instability.

Case presentation:

We present a case of 47-year-old man admitted to the intensive care unit with a diagnosis of respiratory failure and hemodynamic instability 24 hours after closed fracture of the right leg. Before his admission, a thoracic CT angiography was done but did not show any sign of acute pulmonary embolism. During the first hours, he presented a bad evolution with a respiratory status which failed to respond to high-dose of vasopressor, oxide nitric and ventilatory support. Therefore, due to the poor echocardiographic window, transesophageal echocardiography examination was done in emergency. It revealed high-probability diagnosis of massive pulmonary embolism based on right ventricular dysfunction and the presence of thrombus in the right pulmonary artery. Anticoagulant therapy (non-fractionated heparin) was administrated immediately achieving a favorable clinical outcome with rapid withdrawal of dobutamine, nitric oxide and norepinephrine.

Conclusion:

This case illustrates the fundamental role if transesophageal echocardiography in critically ill patient with shock due to high-probability pulmonary embolism. It allows the initiation of adequate treatment without further delay.

Keywords:

Acute pulmonary embolism, transesophageal echocardiography, transthoracic echocardiography, CT chest angiography

Introduction:

Pulmonary embolism (PE) could be difficult to diagnose especially in critical ill patient who are hemodynamically unstable notably if the classic symptoms of PE are absent (1). Although, many cases of PE are diagnosed in emergency context (2). So echocardiography could be considered as useful technique at the bedside in critical care settings for the diagnosis of PE, especially when it is unable to get other confirmations studies (2). That is why, we present this case of massive pulmonary embolism diagnosed by the combined use of transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) due to the poor transthoracic window. TEE was useful by helping in ruling out differential diagnosis of the cause of this shock and finding signs in favor of the diagnosis of PE, which allowed the initiation of adequate treatment without further delay. So, the aim of this case report was to highlights the pivotal role of TEE in the diagnosis of PE in an hemodynamically unstable patient especially when his mobilization is difficult to achieve.

Case presentation:

A 47-year-old man, with no medical history, previous treatment or toxic habit was admitted at hospital with a diagnosis of isolated closed fracture of his right leg due to a road accident (He was struck by a motor vehicle). At the time of admission, he was conscious, without any neurological alteration or hemodynamic and respiratory disorders.

24 hours after the admission, the patient presented suddenly a change in his level of consciousness (confusion with Glasgow come scale of 12). He was tachypneic (30 breaths/min) with an oxygen saturation of 94% with a non rebreather mask. Lung auscultation showed conserved vesicular murmur with bilateral basal crackles. He was tachycardic (heart rate 120 beats/min) and presented a hypotension (blood pressure was 80/40 mmHg). He was not febrile and did not present any cutaneous sign. A 12-lead electrocardiogram showed only a sinus tachycardia without other signs of acute coronary syndrome or right heart strain. The patient was immediately treated with crystalloid fluid infusion and bolus of epinephrine. After that, brain scan was done (without post traumatic abnormalities) in addition to thoracic CT angiography which did not show any sign of acute pulmonary embolism (Figure 1).

Therefore, he was transferred in emergency to the ICU and due to his bad evolution, he was intubated and required mechanical ventilation. Arterial acid-base balance at that time showed fraction of inspired oxygen 100%, pH 7.15, partial pressure of oxygen 86 mmHg, partial pressure of carbon dioxide 52 mmHg, bicarbonates 24 mmol/L, base excess -15, lactic acid 2.5 mmol/L and oxygen saturation 93%. Laboratory finding hemoglobin 10g/dl, leukocytes $6.10^3/\text{mm}^3$, lymphopenia, creatinine 1.5 mg/dl, troponin T 34 $\mu\text{g}/\text{L}$, pro-BnP 400 pg/ml and procalcitonin < 0.05. His respiratory status failed to respond to high-dose of vasopressor and ventilatory support so nitric oxide was introduced in addition to continued infusion of cisatracurium. Chest radiography showed bilateral infiltrate (Figure 2).

In order to determine the real cause of this instability, TTE was performed however we obtained poor quality images so it was necessary to complete with TEE which was performed by an experiment anesthesiologist. TEE demonstrated a dilated and dysfunctional right ventricle (RV) with an hypertrophic dysfunctional left ventricle (LV). The right atrium (RA) was also severely dilated with a patent foramen oval and septum bowing (Figure 3). The RV end-diastolic diameter to LV end-diastolic diameter ratio was 1.2 suggesting RV pressure overload. RV dilatation led to functional tricuspid regurgitation as the tricuspid annulus enlarged. There was a pulmonary arterial hypertension with a pulmonary artery systolic pressure of 70-80 mmHg. Initially, there was no evidence of a thrombus either in the pulmonary arteries or on the right side of the heart. Due to global heart failure and the low-cardiac-output state, dobutamine was used with the doses of 3-5 $\mu\text{g}/\text{kg}/\text{min}$. However, after 24 hours, a control TEE showed an evident thrombus in the right pulmonary artery which was dilated (Figure 4). Massive pulmonary embolism was suspected but we could not confirm it by other complementary test because the unfavorable hemodynamic situation of the patient prevented his transfer. Anticoagulant therapy (non-fractionated heparin) was administered immediately achieving a favorable clinical outcome with rapid withdrawal of dobutamine, nitric oxide and cisatracurium.

Discussion:

This case highlights the crucial role of echocardiography in ICU for patient with severe shock due to massive pulmonary embolism associated to an unfavorable hemodynamic situation. In addition, like many similar cases published in literature, it illustrates the value of TEE over TTE for those who have poor transthoracic window secondary to some clinical situation (supine position or mechanical ventilation) (1).

Pulmonary embolism could be difficult to diagnose particularly for patient in ICU who are sedated or on mechanical ventilation because key symptoms are absent (Dyspnea, chest pain and syncope). For the diagnosis of PE, pulmonary angiography and spiral CT is the gold standard with a sensitivity of 83% and a specificity of 96% according to the PIOPED II trial (3). However, in our scenario, the CT angiography performed initially did not show any sign of acute pulmonary embolism despite the high probability of PE and this could be explained by the occurrence of artefacts or secondary migration of subsegmental thrombosis. So echocardiography was useful in order to ruling out some differential diagnosis which caused this hemodynamic instability (tamponade, aortic dissection, hypovolemia. . .) according to the guidelines of

European Society of Cardiology (4).

Vignon et al showed that TEE helped in 98% of clinical decisions in critical care population so it has higher impact on patient care than TTE which provided adequate images in only 38% of cases (5). Concerning the confirmation of PE, TEE has 70% sensitivity and 81% specificity (6). In context of PE, TEE usually shows indirect signs like RV dilatation (RV end-diastolic diameter/LV end-diastolic diameter ratio > 0.9) and exclude other causes (7). In addition, serial assessment of RV size, determination of RV systolic pressure and inferior vena cava assessment could be performed in patient with massive PE. Although, thrombus may be seen in some cases. According to Pruszczyk et al (8), the central pulmonary arteries including the proximal lobar branches on both sides could be precisely visualized by biplane TEE. Only the proximal left pulmonary artery is difficult to assess because it is shielded by the left main bronchus. But a perimural artefact may be potentially misinterpreted as thrombus especially when it is present in the right pulmonary artery (9).

Besides, significant hemodynamic instability is present in 8% of patient with acute pulmonary embolism. The main cause is acute right ventricular failure which increase mortality from 15% to 42% (10). That is why, TEE could be useful for analyzing response to medical interventions such fluid and drug therapy. It could also be helpful for monitoring RV function and pulmonary artery systolic pressure especially if thrombolytics or anticoagulant were administrated (11).

Conclusion:

We reported this case in order to insist on the fundamental role of TEE in ICU especially when the transthoracic window is poor. It allows the initiation of adequate treatment without further delay, by avoiding an unnecessary mobilization of an unstable patient to perform CT chest angiography leading to a better clinical outcome. Although, it has some limitations like the cost of the equipment or the inability to place a probe (esophagectomy, esophageal diverticula or varices) however, complications rates from TEE use are fairly low 0.2% (12). In addition, it was demonstrated that it had a steep learning curve and that physicians could successfully perform focused TEE assessments with a high retention rate after 6 weeks of 4-hour simulation workshop (13).

Figures legend: Figure 1: CT chest angiography Figure 2: Chest radiography Figure 3: Mi esophageal 4-chamber view Figure 4: High esophageal view

References:

1. Miranda-Bacallado J, Izquierdo-Gómez MM, García-Niebla J, Jiménez JJ, Iribarren JL, Laynez-Cerdeña I, et al. Role of echocardiography in a patient with suspected acute pulmonary embolism: a case report. *Journal of Medical Case Reports* [Internet]. 2019 Dec [cited 2020 Aug 3];13(1). Available from: <https://jmedicalcasereports.biomedcentral.com/articles/10.1186/s13256-019-1994-y>
2. Fields JM, Davis J, Girson L, Au A, Potts J, Morgan CJ, et al. Transthoracic Echocardiography for Diagnosing Pulmonary Embolism: A Systematic Review and Meta-Analysis. *J Am Soc Echocardiogr*. 2017 Jul;30(7):714-723.e4.
3. Stein PD, Fowler SE, Goodman LR, Gottschalk A, Hales CA, Hull RD, et al. Multidetector Computed Tomography for Acute Pulmonary Embolism. *New England Journal of Medicine*. 2006 Jun 1;354(22):2317-27.
4. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS) | *European Heart Journal* | Oxford Academic [Internet]. [cited 2020 Aug 3]. Available from: <https://academic.oup.com/eurheartj/article/41/4/543/5556136>
5. Vignon P, Mentec H, Terré S, Gastinne H, Guéret P, Lemaire F. Diagnostic accuracy and therapeutic impact of transthoracic and transesophageal echocardiography in mechanically ventilated patients in the ICU. *Chest*. 1994 Dec;106(6):1829-34.

6. Kline JA, Johns KL, Colucciello SA, Israel EG. New diagnostic tests for pulmonary embolism. *Ann Emerg Med.* 2000 Feb;35(2):168–80.
7. Torbicki A, Perrier A, Konstantinides S, Agnelli G, Galiè N, Pruszczyk P, et al. Guidelines on the diagnosis and management of acute pulmonary embolism: the Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). *Eur Heart J.* 2008 Sep;29(18):2276–315.
8. Pruszczyk P, Torbicki A, Kuch-Wocial A, Szulc M, Styczynski G, Bochowicz A, et al. Visualization of the central pulmonary arteries by biplane transesophageal echocardiography. *Exp Clin Cardiol.* 2001;6(4):206–10.
9. Bedet A, Razazi K, May F, Mekontso Dessap A. Transesophageal echocardiography for pulmonary embolism diagnosis in the intensive care unit: artifact in three dimensions. *Intensive Care Medicine.* 2017 Feb;43(2):261–2.
10. Zhao S, Friedman O. Management of Right Ventricular Failure in Pulmonary Embolism. *Critical Care Clinics.* 2020 Jul;36(3):505–15.
11. Porter TR, Shillcutt SK, Adams MS, Desjardins G, Glas KE, Olson JJ, et al. Guidelines for the Use of Echocardiography as a Monitor for Therapeutic Intervention in Adults: A Report from the American Society of Echocardiography. *Journal of the American Society of Echocardiography.* 2015 Jan 1;28(1):40–56.
12. Kallmeyer IJ, Collard CD, Fox JA, Body SC, Shernan SK. The safety of intraoperative transesophageal echocardiography: a case series of 7200 cardiac surgical patients. *Anesth Analg.* 2001 May;92(5):1126–30.
13. Arntfield R, Pace J, McLeod S, Granton J, Hegazy A, Lingard L. Focused transesophageal echocardiography for emergency physicians-description and results from simulation training of a structured four-view examination. *Crit Ultrasound J.* 2015 Dec;7(1):27.

Hosted file

Figures.pdf available at <https://authorea.com/users/298537/articles/511590-role-of-transesophageal-echocardiography-in-a-patient-with-an-initially-misdiagnosed-acute-pulmonary-embolism-a-case-report>