

OPIS PRZYPADKU / CASE REPORT

Otrzymano/Submitted: 10.12.2020 • Zaakceptowano/Accepted: 20.12.2020

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TEE diagnosis of sudden hypoxia three days post pulmonary thrombendarterectomy – a case report**Tomasz Bartkowiak¹, Massimiliano Meineri², Marc De Perrot³, Krzysztof Kusza¹, Marcin Wąsowicz²**¹ Anesthesiology, Intensive Therapy and Pain Unit University Hospital im.H.Święcickiego UM im. K.Marcinkowskiego, Poznan² Department of Anesthesia and Pain Management Toronto General Hospital/University Health Network, Canada³ Department of Surgery Toronto General Hospital/University Health Network, Canada**Abstract**

Background. Pulmonary thrombendarterectomy is a complex cardiac operation performed in patient suffering from chronic pulmonary embolism, which leads to pulmonary hypertension. Operation is being conducted with use of cardiopulmonary bypass and circulatory arrest and is aiming at removal of organized thrombi from pulmonary arteries. **Case report.** We present a case of an unusual post-operative complication [1] where transesophageal echocardiography (TEE) led to prompt diagnosis of localized right atrial compression and a new right to left shunt. These findings changed the course of treatment, eliminated need of ECMO and prompted a therapeutic chest re-exploration. *Anestezjologia i Ratownictwo 2020; 14: 323-326.*

Keywords: *pulmonary thrombendarterectomy, transesophageal echocardiography, ECMO*

Case presentation

A 74-year old female with chronic thromboembolic pulmonary hypertension (PHT) underwent uneventful pulmonary thrombendarterectomy (PTE). Her medical history included: Arterial hypertension, Chronic Obstructive Pulmonary Disease, severe Pulmonary Hypertension (PHT) - WHO Group 4, (PAP – Pulmonary Arterial Pressure 113/32 mmHg, mean PAP 66 mmHg on right heart catheterization). Preoperative transthoracic echocardiography (TTE) revealed: Right Ventricle (RV) dysfunction, ostium secundum type atrial septal defect (ASD) - (1.5 cm by 2 cm with left to right shunt).

Based on clinical history and radiological evaluation multidisciplinary team did not recommend ASD closure at the time of surgery given the degree of PHT and significant risk of right heart failure, hypoxemia

and cardiovascular collapse. On postoperative day 3 patient suddenly developed severe hypoxia and cardiovascular collapse. Despite optimal medical therapy with mechanical ventilation, use of nitric oxide (NO) and vasopressors patient remained profoundly hypoxic. Urgent bedside TTE examination by treating physician was performed and showed a hematoma over right atrium without evidence of cardiac tamponade, moderate dilatation of RV and RV pressure overload with flattening of interventricular septum during systole. Because patient has no cardiac tamponade and optimal treatment failed to improve patient oxygenation and hemodynamic status patient was qualified for urgent VA ECMO (veno-arterial Extra Corporeal Membrane Oxygenation).

In order to safely initiate treatment with extracorporeal membrane oxygenation (ECMO), surgeon asked cardiac anesthesiologist on call for TEE assi-

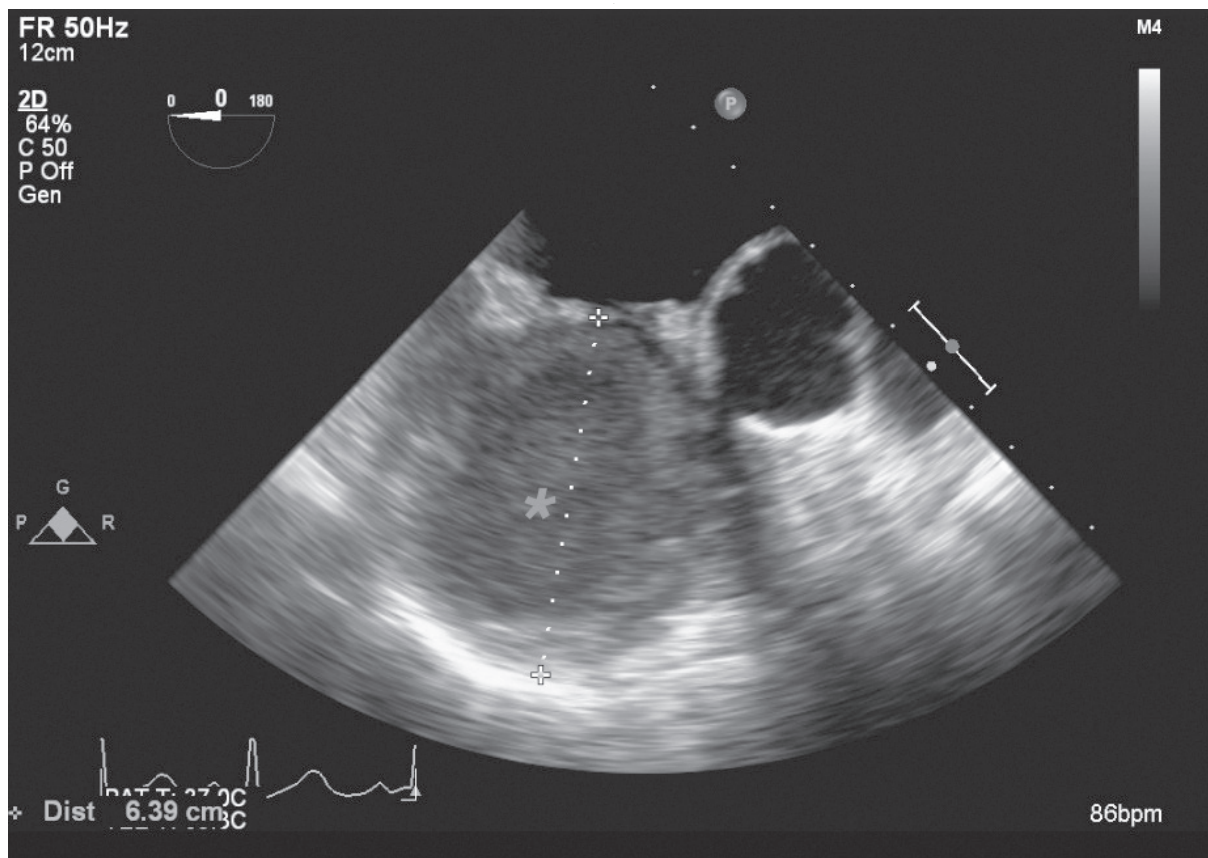


Figure 1. Modified Mid Esophageal four chamber view demonstrating Right Atrium compression by a large clot (asterisks)

stance for ECMO cannulas insertion. As a part of preparation for the ECMO cannulation bedside transesophageal echocardiography (TEE) was performed. TEE findings showed a hematoma over right atrium without echocardiographic evidence of cardiac tamponade, moderate dilatation of RV with moderately reduced systolic function and evidence of RV pressure overload with flattening of IVS during systole. Hematoma location compressed RA and directed flow from IVC towards ostium secundum and causing large right-to-left shunt and subsequent hypoxia and hemodynamic instability.

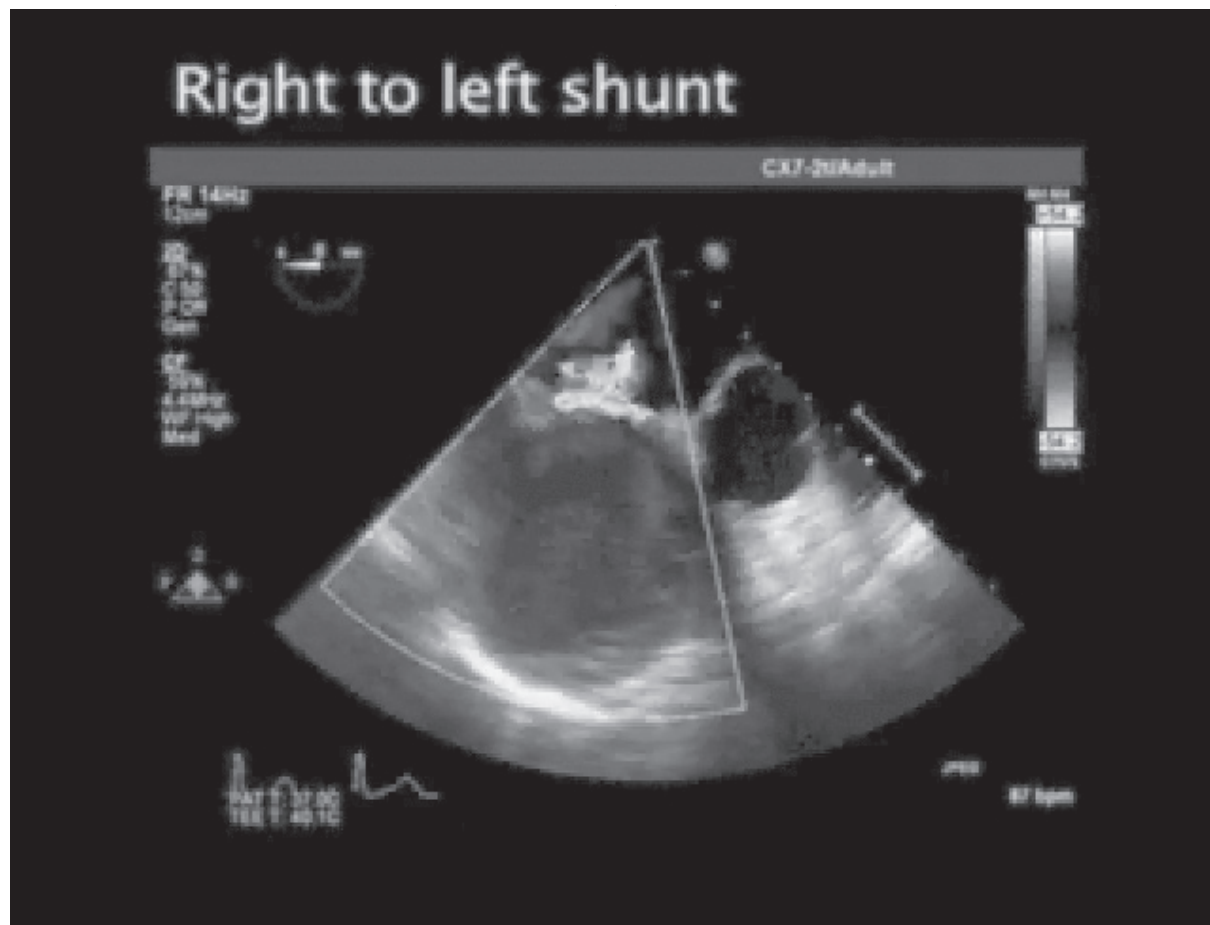
Patient underwent urgent sternotomy and clot removal with immediate return to hemodynamic stability and normoxia. Intraoperative TEE post clot removal revealed: mild to moderate RV dysfunction, moderate TR, large ASD with predominantly left to right shunt. The patients was successfully discharged home 33 days later.

Discussion

In our case, bedside TTE failed to reveal right to left shunt and prompted a potentially unnecessary intervention. TEE provided new and critical information that guided immediate and definite treatment.

Hemodynamic instability or shock after major operations like for example PTE is a recognized indication for both transthoracic and transesophageal echocardiography examination in order to assess volume status and, prediction of fluid responsiveness and response to therapy. [2]

The reasons why TTE did not reveal correct diagnosis is probably related to inadequate visualization of relevant cardiac structures. It is a common problem after sternotomy and in patients with chronic lung disease. Both factors contribute to poor echocardiographic windows early in the postoperative course. Additionally, in this case mechanical ventilation, and pericardial



Video 1. Modified Mid Esophageal 4 chamber view Right to Left shunt
https://www.akademiamedycyny.pl/wp-content/uploads/2021/03/TEE_case_AiR.mp4

drains located in subcostal area might have caused poor visualization. Other important factor is that the second examination (TEE) was performed by experienced cardiac anesthesiologist familiar with this type of procedure and certified with TEE who could easily identify the underlying cause of profound hypoxia.

Potential complication of PTE include reperfusion injury including massive hemoptysis with subsequent poor gas exchange, persistent pulmonary hypertension, and right ventricular failure. Patients suffering from these complications early after surgery present with high morbidity and mortality.

Gas exchange, RV function, pulmonary vascular resistance (PVR), and cardiac output are all part of heart-lung interaction. Therefore, early initiation of venoarterial ECMO is necessary to prevent the vicious cycle of hypoxic vasoconstriction increasing PVR, with

reduction in cardiac output. Early institution of V-A ECMO support has an advantage of decreasing right heart volume and allowing recovery of ventricular function and optimizing oxygen delivery by improving cardiac output. In other words ECMO has a role as a rescue therapy post-PTE in patients with severe compromise who would probably otherwise die (3).

In our case diagnostic modalities differentiating causes of hypoxia and cardiovascular compromise including X-ray, TTE failed to diagnose the cause of patient's deterioration.

Reperfusion injury may be easily diagnosed by an X-ray, lung TTE or using some parameters of transpulmonary termodilution like ELWI (Extravascular Lung Water Index) and PVI (Pulmonary Vascular Permeability Index). Other common causes of hypoxia, for example pulmonary hemorrhage which usually

occurs during operation can be detected visually by detecting blood in endotracheal tube and during bronchoscopy. Theoretically there is some role of cardiac MRI to assess heart function but it seems not to be feasible in urgent situation.

In presented case where source of hypoxia is related to compression of right atrium which steered blood from IVC and SVC via ASD ostium secundum to left atrium causing huge right-to left shunt, TEE is the most accurate, quick and useful tool to diagnose this pathology.

According to American Society of Anesthesiologist and Society of Cardiovascular Anesthesiologist, life-threatening hemodynamic disturbances are classified as a category I indication for the intraoperative use of transesophageal echocardiography. TEE is invaluable diagnostic tool in cardiac anesthesia, may provide additional diagnostic information in patients with intraoperative cardiac arrest and may directly guide specific, potentially life-saving therapy [4].

During COVID-19 pandemic ECMO Teams have faced the challenge of treating seriously ill patients [5]. Increasing number of ECMO insertion in COVID time pose a chance for critically ill patients. Echocardiography included TEE plays a crucial role at every step of ECMO support.

It provides information that assists in patient selection, guides the insertion and placement of can-

nulas, monitors progress, detects complications and helps in determining cardiac recovery and weaning of ECMO support [6,7]. Nevertheless, there are currently no guidelines on the use of echocardiography in the setting of ECMO in adults.

Conclusion

Transesophageal echocardiography should be considered as a diagnostic choice not only in post-surgical intubated patients but also during intraoperative cardiac arrest or pre ECMO examination, ECMO canulas insertion and routine care of EMCO patients. In conclusion basic TEE should be the part of the critical care armamentarium of anesthesiologists and critical care physicians.

Conflict of interest

None

Correspondence address

✉ Tomasz Bartkowiak
Anesthesiology, Intensive Therapy and Pain Unit
University Hospital im. H. Świącickiego
UM im. K.Marcinkowskiego w Poznaniu
49 Przybyszewskiego St., 60-355 Poznan
☎ (+48 61) 86 91 357
✉ banczak@gmail.com

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