



## A large biatrial thrombus entrapped by patent foramen ovale in a case with massive pulmonary embolism

*Masif pulmoner embolili olguda patent foramen ovaleye tuzaklanmış biatriyal geniş trombüs*

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### ABSTRACT

Thrombus development in cardiac chambers increases the risk of mortality, compared to pulmonary embolism alone, and can require change in therapy. In the presence of patent foramen ovale, paradoxical systemic embolization can occur associated with a higher incidence of death and embolic complications. Herein, we present a case of pulmonary embolism concomitant a right atrial huge thrombus entrapped in patent foramen ovale and prolapsing into the left heart chambers.

**Keywords:** Patent foramen ovale; pulmonary embolism; thrombus.

### ÖZ

Kalp boşluklarında trombüs gelişimi, tek başına pulmoner emboli ile karşılaştırıldığında, mortalite riskini artırır ve tedavi değişikliğine yol açabilir. Patent foramen ovale varlığında, yüksek emboli komplikasyonu ve ölüm sıklığı ile ilişkili sistemik paradoksal emboli gerçekleşebilmektedir. Bu yazıda, patent foramen ovaleye tuzaklanmış ve sol kalp boşluklarına sarkan sağ atriyal büyük trombüsün eşlik ettiği pulmoner emboli olgusu sunuldu.

**Anahtar sözcükler:** Patent foramen ovale; pulmoner emboli; trombüs.

Pulmonary embolism (PE) is often caused by thrombi originating from deep vein thrombosis (DVT) and can lead to acute right heart failure and cardiogenic shock. Thrombi in cardiac chambers appear to increase the risk of mortality, compared to PE alone, and can require a change in therapy. In the presence of patent foramen ovale (PFO), paradoxical systemic embolization can occur, particularly when the pulmonary arterial and right atrial pressures are elevated and associated with a significantly higher incidence of death and embolic complications such as ischemic stroke.<sup>[1,2]</sup> Herein, we present a case of PE concomitant a right atrial huge thrombus entrapped in PFO and prolapsing into the left heart chambers.

### CASE REPORT

A 63-year-old woman was admitted with sudden-onset dyspnea. Her initial physical examination revealed a blood pressure of 100/60 mmHg and respiratory rate of 28 per min. Electrocardiography showed sinus tachycardia and SIQ3T3 pattern. Laboratory studies showed an elevated troponin and D-dimer levels. Pulmonary computed tomography (CT) showed massive bilateral PE (Figure 1). Transthoracic echocardiography (TTE) showed a dilated poorly functioning right ventricle with floating thrombus extending from the right atrium (RA) to the left atrium (LA) through PFO. Systolic pulmonary artery pressure was 50 mmHg. Transesophageal echocardiography

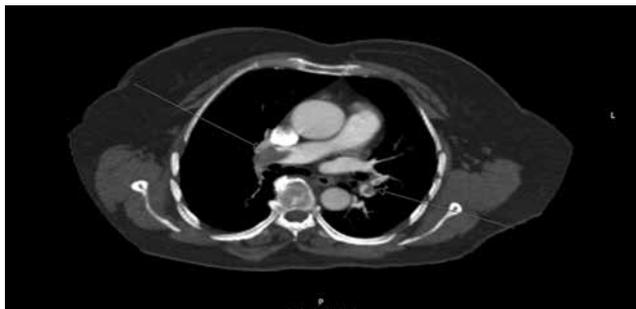
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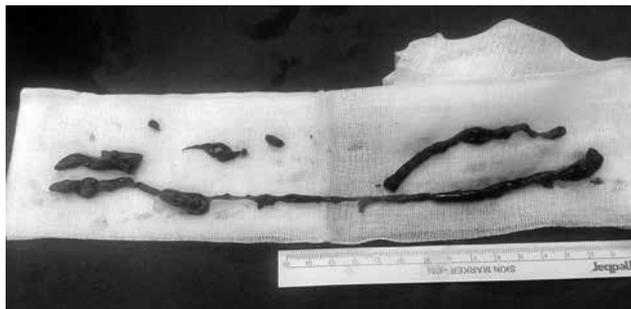
**Figure 1.** Pulmonary computed tomography showing massive bilateral pulmonary embolism.

(TEE) was performed and a huge thrombus was detected in the foramen ovale on its way to the LA. A written informed consent was obtained from the patient and urgent surgical embolectomy with closure of the PFO was performed. During the procedure, RA was opened and a 12 cm length thrombus was revealed. The main pulmonary artery was opened and the thrombus was removed (Figure 2). In a perioperative period, the patient's blood pressure decreased gradually. Despite the adequate fluid resuscitation and maximal inotropic therapy, the patient remained hypotensive. Since hypoxemia was persistent, despite 100% fraction of the inspired oxygen, she was connected to the venoarterial extracorporeal membrane oxygenation (VA-ECMO) device. Using the VA-ECMO, oxygen saturation and blood pressure returned to normal levels. During the follow-up, she was gradually weaned off the VA-ECMO support, and inotropic support under VA-ECMO was gradually decreased. The patient was extubated on Day 17 of hospitalization. After extubation, her vital signs remained stable and the patient was discharged with fully arranged oral anticoagulation therapy.

## DISCUSSION

Free floating right heart thrombi are uncommon, and they are always associated with acute PE.<sup>[3]</sup> Paradoxical movement of the thrombus across PFO indicates the reversal of flow from the RA to the LA due to acute PE.<sup>[4]</sup> The diagnosis is mostly made correctly by TTE, and, when necessary, TEE can be performed successfully.<sup>[5]</sup> Surprisingly, more than one-half of the reported cases had an atypical clinical presentation without a paradoxical systemic embolization or PE.

In our patient, we detected an entrapped thrombus at the PFO, most probably due to DVT, but without systemic embolization. Doppler examination revealed a thrombosis of the deep veins of the right leg. In such cases, Duplex scanning of abdominal and deep



**Figure 2.** Operative specimen revealing a long clot extracted from urgent thrombectomy of right atrium.

veins of the legs is also recommended, particularly to examine the possibility of placing an inferior vena cava filter or clip. It is prudent to perform pulmonary CT angiography as a first-line approach to assess for the presence of PE.

Treatment of PE with an entrapped thrombus in PFO is controversial. Anticoagulation, thrombolytic therapy or surgical intervention are the treatment options; however, there is no consensus on the optimal treatment of this clinical situation. Thrombolytic therapy is simple, rapid, available, although hemorrhage or dislodgement of the fixed thrombus may occur, resulting in increased mortality. In our case, we used the surgical option, despite the risk of cardiac surgery, as she had cardiac failure. This therapeutic choice seemed to be more rapid and complete than the other options, as PFO would be closed at the same time.<sup>[6]</sup> In a recent review, surgical thromboembolectomy yielded improved survival rates and reduced ischemic stroke, compared to anticoagulation therapy. On the other hand, the mortality rate remains high (27 to 41%) after the surgical procedure. There was no embolization reported after the surgical thrombus removal. Several studies reported that almost 65% of such patients underwent surgery, and the mortality rate was 9.7% vs 36% and 32% mortality in patients who underwent thrombolysis or anticoagulation therapy.<sup>[7,8]</sup>

In addition, the VA-ECMO device was used in our case to support the right ventricle and improve oxygen saturation. There are two types of ECMO: VA-ECMO and veno-venous (VV) ECMO.<sup>[9]</sup> While both provide respiratory support, VA-ECMO additionally improves the hemodynamic condition. As our patient remained hypotensive, despite maximal inotropic therapy, and hypoxemia persisted, despite 100% fraction of inspired oxygen, we used VA-ECMO device. Using the ECMO device in combination with surgical embolectomy in the management of massive PE was firstly described

in 1961.<sup>[10]</sup> Over the years, ECMO therapy has been increasingly used with good results for patients who do not respond to the standard treatment or as a bridge to surgery. In selected patients, ECMO therapy may be a reasonable to ensure hemodynamic stabilization.

In conclusion, on the basis of our experience and review of the reported cases of entrapped thrombus in patent foramen ovale associated with pulmonary embolism, we conclude that surgery seems to have the most optimal results among the therapeutic options for these patients.

#### **Declaration of conflicting interests**

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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