A large thrombus in Transit within a patent foramen ovale with massive pulmonary embolism : A rare case report

ABSTRACT

Reports of thrombi straddling the patent foramen ovale (PFO) are uncommon occurrences. The development of thrombi within the cardiac chambers poses a greater risk of mortality compared to pulmonary embolism (PE) alone and may necessitate a change in treatment strategy(1). In this case, we describe a rare scenario involving a 53-year-old patient who presented with massive pulmonary embolism. Echocardiography revealed a large thrombus trapped within the patent foramen ovale, protruding into the left heart chambers and causing increased pulmonary artery pressure—a highly unusual and critical condition. Echocardiography emerges as a valuable and safe tool in demonstrating the size, location, and extent of a thrombus, playing a crucial role in the prompt diagnosis and evaluation of treatment options for individuals with a thrombus trapped within a PFO alongside concurrent pulmonary embolism. Our patient received treatment with thrombolysis and anticoagulation, ultimately achieving an uneventful recovery. While the treatment in this case yielded satisfactory results, it may not be universally applicable. Given the rarity of this diagnosis and the limited available data, there is no formally established treatment guideline. Nevertheless, in patients deemed suitable for surgery, studies have indicated improved outcomes with surgical embolectomy compared to anticoagulation alone or thrombolysis. Anticoagulant therapy may represent an acceptable therapeutic alternative, especially for patients with comorbidities at high surgical risk or those with small PFOs. Notably, thrombolysis is associated with the highest mortality, potentially explained by the severity of the patient's initial presentation.

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

Introduction

“Thrombus straddling the patent foramen ovale (PFO) is an exceedingly rare and critical condition” (2). Thrombi within the cardiac chambers are known to escalate the risk of mortality compared to pulmonary embolism (PE) in isolation, often necessitating a change in treatment approach(3). In the presence of a patent foramen ovale (PFO), there is a potential for paradoxical systemic embolization, especially when pulmonary arterial and right atrial pressures are elevated. This scenario can facilitate the passage of the transitional thrombus through the PFO, thereby increasing the risk of embolic complications, including ischemic stroke and even sudden death(4,5).Due to the extreme rarity of this finding, the clinical characteristics and optimal therapeutic management of such cases remain unclear. The treatment of a transitional thrombus in patients with PE is a matter of debate. Available therapeutic options encompass surgical interventions involving thrombectomy or medical

treatments involving heparin or thrombolysis. Surgical embolectomy has shown a tendency toward improved survival, albeit with a high postoperative mortality rate(6). We present a remarkable case involving a 53-year-old patient who had a substantial right atrial thrombus entrapped in the PFO, extending into the left heart chambers and associated with extensive bilateral PE. The patient underwent thrombolytic and anticoagulation therapy, and after 30 days, she was discharged from the hospital with a successful and uneventful recovery. This case report serves to emphasize that thrombolytic and anticoagulant therapy can be considered as an alternative treatment option in this rare and challenging condition.

Case presentation

A 53-year-old women was brought to the emergency department with a 1-week history of chest tightness, unspecified chest pain, and shortness of breath . Of note, she lived a sedentary lifestyle since 26 days following to a second degree burn of the 2 legs (Figure 1). She had no notable family history, takes no treatment and is not followed for neoplasia. She reported the spontaneous onset of recurrent unspecified chest pain associated with stage 3 NYHA dyspnea. The patient had no palpitations or neurological symptom prior to the discomfort. Upon arrival, the patient was conscious and oriented with a Glasgow score of 15/15. She had a body temperature of 38°C, the systolic blood pressure was measured at 120 mmHg, and the diastolic blood pressure at 60 mmHg, the heart rate at 100 beats per minute. She was breathless, with a respiratory rate of 31 cycles per minute with a capillary oxygen saturation in ambient air of 85%. On cardiac examination, she had normal heart sounds with regular rhythm and no murmurs, rubs, or gallops. Extremities were without oedema and the left foot wound was well healed.The peripheral pulses are all perceived and symmetrical. The abdomen was soft, painless, without palpable hepatosplenomegaly, and the superficial lymph nodes were free. The electrocardiogram showed a sinusal tacchycardia at 100 beats per minute, with no anomaly in the PR space, negative T waves in the antero-septal leads (Figure 2). The initial biological assessment finds a hemoglobin at 12,1 g/dl, platelets at 267000/µl, serum creatinine at 7.5 mg/l, D-dimers at 41560 ng/ml, highly sensitive cardiac troponin marker at 4510 ng/l and C-reactive protein 35 mg/l. The hemostasis assessment was without abnormality. The performed transthoracic echocardiography (TTE) showed a large serpentine, free-floating echogenic mass in the right atrium(Figure 3) and extending to the left atrium(Figure 4) through a PFO (Figure 5)part of the mass moved to the left ventricle during diastole. The right heart cavities were dilated, and moderate right ventricular dysfunction was present. No emboli were visible in the central pulmonary artery. The systolic pulmonary artery pressure was 57 mmHg. Left ventricular function was normal. Based on the TTE findings, we decided to perform transesophageal echocardiography (TEE). However, the patient had an esophageal diverticulum; therefore, TEE was not carried out.

The angio-computed tomography scan confirmed a massive bilateral proximal pulmonary embolism with acute severe pulmonary hypertension without parenchymal lesions of the lungs(Figure 6). Lower limb venous echo-Doppler showed a right femoral thrombosis.

The patient was hemodynamically stable. However, she reported that her chest tightness and shortness of breath had worsened. After a discussion with the patient and her family and surgeons, the patient underwent thrombolytic and anticoagulant therapy. Recombinant tissue

plasminogen activator and heparin was administered by a continuous pump from 24 to 48 hours. This was followed by subcutaneous injection of low-molecular-weight heparin and oral warfarin for 3 days, and the oral warfarin was sustained thereafter. After 30 days of treatment, the serum D-dimer level had decreased to normal. Pulmonary computed tomography angiography showed that the PE had disappeared . Follow-up TTE revealed no thrombus in the heart cavities . The right heart cavities had recovered to normal size. The pulmonary artery systolic pressure decreased to 25 mmHg. No left-to-right shunt was present through the foramen ovale. The patient was discharged from the hospital with an uneventful recovery.

Discussion

The visualization of a thrombus within the right atrium, referred to as a "thrombus in transit," is an exceptionally rare echocardiographic finding that carries a significantly high mortality rate, estimated to be as high as 29%(7,8). Even rarer is the occurrence of a thrombus crossing the patent foramen ovale (PFO)(9,10). Patients with an embolus straddling the PFO are at risk of death due to cardiogenic shock and/or right heart failure in 44% of cases and death due to stroke in nearly 16%(11).In the case presented here, it's important to note that the foramen ovale is a remnant from the embryonic period and serves as a potential communication channel between the right and left atria. Normally, the foramen ovale closes around 5 to 7 months after birth due to the fusion of the first and second atrial septa. However, in a significant percentage of normal adults (approximately 25% to 34%), the foramen ovale may not completely fuse, leaving a potential gap or separation between the septum primum and secundum, known as a PFO(12). “Under typical conditions, because the pressure in the left atrium is higher than that in the right atrium, there is usually no left-to-right shunt through the atrial septum. However, the interatrial pressure gradient can be reversed, which may occur during activities like coughing, laughing, or the Valsalva maneuver. It can also happen in patients with pulmonary hypertension induced by conditions such as coughing, laughing, the Valsalva maneuver, pulmonary embolism (PE), or congenital heart disease. Once the pressure in the right atrium exceeds that in the left atrium, the foramen ovale can open from right to left, allowing a thrombus from the venous system to easily cross into the left atrium through a PFO” [16].

The first reported case of a thrombus-in-transit diagnosed by echocardiography was in 1985 by Nellessen et al., and to date, fewer than a hundred cases have been reported in the literature. In previous studies, the mortality rate associated with a paradoxical embolism secondary to a thrombus-in-transit was as high as 18%, with 66% of patients succumbing within 24 hours(12). Given the high mortality rate associated with a thrombus-in-transit(13), early diagnosis and treatment are of paramount importance. Echocardiography not only aids in identifying the location and size of emboli but also plays a crucial role in making prompt management decisions. In cases where a more detailed assessment is needed, transesophageal echocardiography (TEE) can be performed successfully. In the case of our patient, she presented with acute shortness of breath and was found to have a saddle pulmonary embolism with a massive clot burden and a thrombus-in-transit straddling the PFO—a perilous

diagnosis, likely stemming from deep vein thrombosis (DVT), but without systemic embolization. Doppler examination also revealed thrombosis in the right femoral vein..

“The optimal management of pulmonary embolism (PE) with an entrapped thrombus in the patent foramen ovale (PFO) remains a subject of controversy. Treatment options include anticoagulation, thrombolytic therapy, or surgical intervention, but there is no consensus on the best approach for this clinical scenario. Anticoagulation and thrombolysis therapy may pose risks in patients with a large thrombus-in-transit within a PFO due to the potential for thrombus fragmentation or complete embolization” (13). However, Rose et al.(14) reviewed “many cases over a 34-year period and found that the mortality rate was lower after thrombolytic therapy compared to surgery”. “Additionally, based on a previous review, “anticoagulant treatment appears to be an acceptable therapeutic alternative to surgery, especially for patients with comorbidities (such as advanced age, history of stroke, or progressive cancer) who are at high surgical risk or for patients with small PFOs” (15). Surgical treatment is warranted in cases where the goal is to prevent paradoxical embolism, and it should be performed promptly if chosen as the preferred treatment strategy. A recent review suggested that “surgical thromboembolectomy improved survival rates and reduced ischemic stroke compared to anticoagulation therapy, although the difference in mortality between the heparin-treated group and the surgical group was minimal (14% vs. 12%, respectively). Thrombolysis was associated with the highest mortality rate (36%), likely due to the severity of the patient's initial presentation” (15). A study by Myers et al.(2) “in 2010 reviewed observational studies on this topic to identify prognostic factors and compare mortality and systemic embolism rates between different treatments. Surgical thromboembolectomy showed a trend toward improved survival and significantly reduced rates of systemic embolism and the composite of mortality and systemic embolism compared to anticoagulation alone. Thrombolysis, on the other hand, had the opposite effect, although not statistically significant”. In the case of our patient, while she was hemodynamically stable, her symptoms of chest tightness and shortness of breath were worsening. Furthermore, the PE exhibited extensive bilateral involvement, including segmental arteries, and a lower extremity vascular ultrasound revealed a right femoral thrombosis. Given these factors, the decision was made to proceed with thrombolytic and anticoagulation treatment, which ultimately resulted in a positive therapeutic outcome.

Conclusion

Thrombus straddling the foramen ovale (TSFO) is a complication associated with severe thromboembolic disease, characterized by the migration of a thrombus into the left-heart chambers, often contributing to the development of pulmonary hypertension. The diagnosis of TSFO can be readily made using echocardiography, although sometimes a transesophageal echocardiogram (TEE) is necessary for clearer visualization. Echocardiography is invaluable not only for diagnosis but also for guiding early management decisions and monitoring the response to anticoagulation therapy during follow-up. In the case of the patient described, thrombolytic and anticoagulation therapy was employed to treat TSFO, leading to the complete resolution of the thrombus and embolism. However, it's important to note that this treatment approach may not be suitable for every patient due to considerations related to age

and comorbidities. The management strategy should be tailored to each individual's specific clinical circumstances and risk factors

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

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Figure1. A second degree burn of the 2 legs.

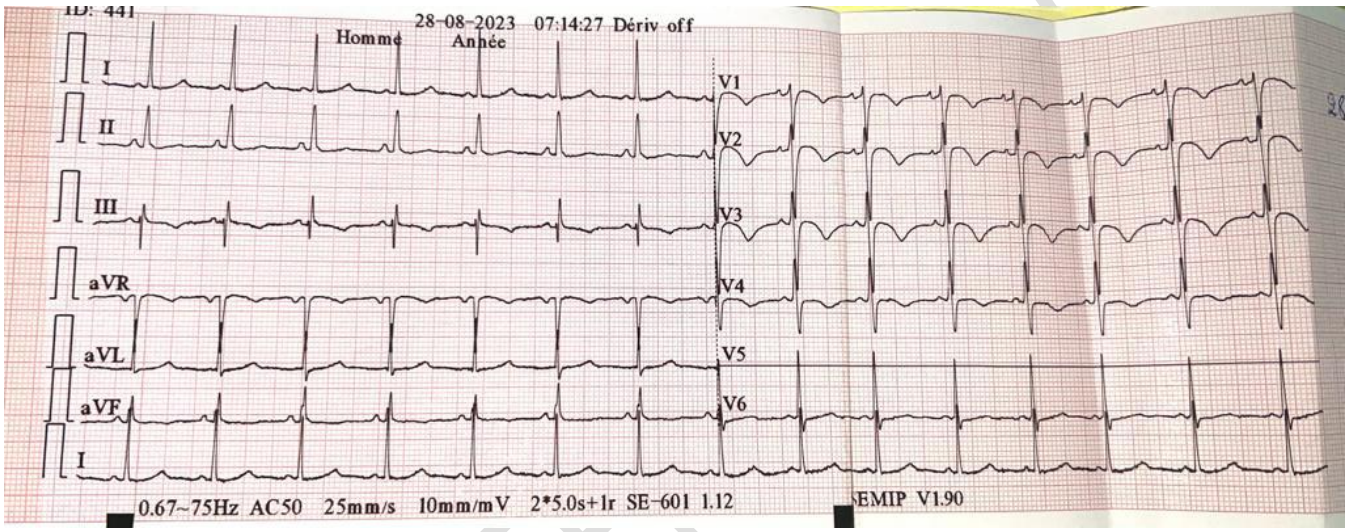

Figure 2. . ECG shows negative T waves in the antero-septal leads.

Figure 3. TTE chambers view zoom centered on the RA : a large snake-like thrombus (red arrow) in the right atrium.

Figure 4 .TTE long axis parasternal cut : a serpentine thrombus (green arrow) in the left atrium.

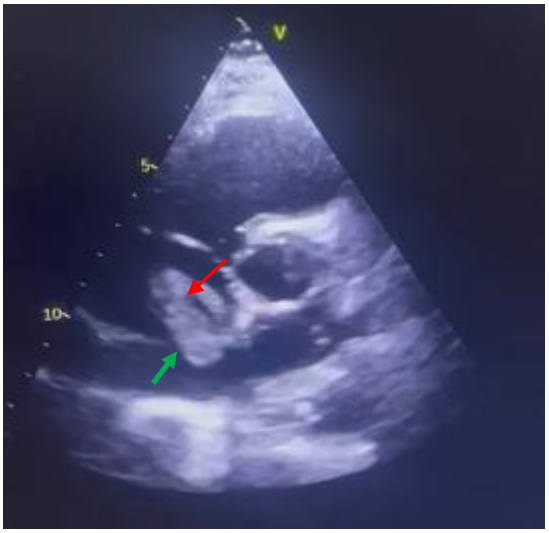

Figure 5. TTE Short axe view : a large thrombus (red arrow)entrapped in the patent foramen ovale(PFO).

Figure 6. Thoracic angio-CT scan: massive bilateral pulmonary embolism.