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Thromboembolism-in-Transit and Patent Foramen Ovale: Should Screening Echocardiogram Be Routine for Thromboembolic Disease?

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Background: Thromboembolism-in-transit straddling a patent foramen ovale (PFO) is a rare condition that requires urgent surgical intervention to prevent arterial emboli.

Case Report: We present the case of a 42-year-old female who presented with a symptomatic pulmonary embolism. Echocardiography identified a PFO, with a bridging thrombus-in-transit and evidence of right ventricular strain. Urgent surgery was performed because of the risk of systemic embolism. A large thrombus was identified during biatrial exploration. Pulmonary embolectomy and primary PFO closure were performed.

Conclusion: Because of the 20%-30% incidence of PFOs in the general population, we suggest that echocardiography should be considered for routine surveillance in thromboembolism because of the risk of systemic sequelae.

Keywords: *Echocardiography, foramen ovale–patent, thromboembolism*

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INTRODUCTION

Anticoagulant therapy has been the mainstay treatment for thromboembolic disease. Invasive therapies such as catheter-directed thrombolysis and pulmonary embolectomy are reserved for hemodynamically unstable patients who are not candidates for systemic thrombolytics. The rare case of thromboembolism with a coexisting intracardiac shunt, however, poses an immediate risk of systemic embolism. We present the case of a thromboembolism-in-transit across a patent foramen ovale (PFO) that was managed surgically.

CASE REPORT

A 42-year old female presented with dyspnea 6 days after an outpatient cosmetic procedure. She had no personal or family history of thromboembolic disease and no personal history of smoking. Computed tomography angiography of the chest demonstrated a large pulmonary embolism (PE) in the right pulmonary artery and dilation of the right atrium and right ventricle. The patient was hemodynamically stable, but because of the right ventricular (RV) dilation, a transthoracic echocardiogram was obtained to further evaluate RV strain. Transthoracic echocardiogram demonstrated RV strain and an embolus bridging a PFO into the left atrium (Figure 1).

Because of the imminent risk of systemic embolization, the patient was taken to the operating room for biatrial exploration, pulmonary embolectomy, and PFO closure. One intact thrombus was removed from both atria (Figure 2). The left atrial appendage, pulmonary veins, and valvular apparatus were examined thoroughly to exclude other thrombi. The patient's postoperative course was unremarkable. A temporary inferior vena cava filter was placed percutaneously, and the patient was discharged home on postoperative day 6 on warfarin with no systemic embolic events or neurologic dysfunction. Six months later, the filter was removed. At 4 years postoperatively, she is alive and well with no recurrent venous thromboembolism (VT) and reports a recreational exercise equivalent of 4-5 metabolic equivalents.

DISCUSSION

PE is the third most common cardiovascular disease after myocardial infarction and stroke. While rates of myocardial infarction and stroke seem to be diminishing, annual event-rates of VT have been increasing, as shown in a 25-year population-based study.[1] The overall incidence of PFO in the general population is 20%-30%, based on autopsy studies. With increasing age, the incidence decreases, from a high of 34% in patients $<$30 years old to 20% in the 9th-10th decade. However, PFO size increases with age up to a mean diameter of 5.8 mm in the 10th decade.[2]

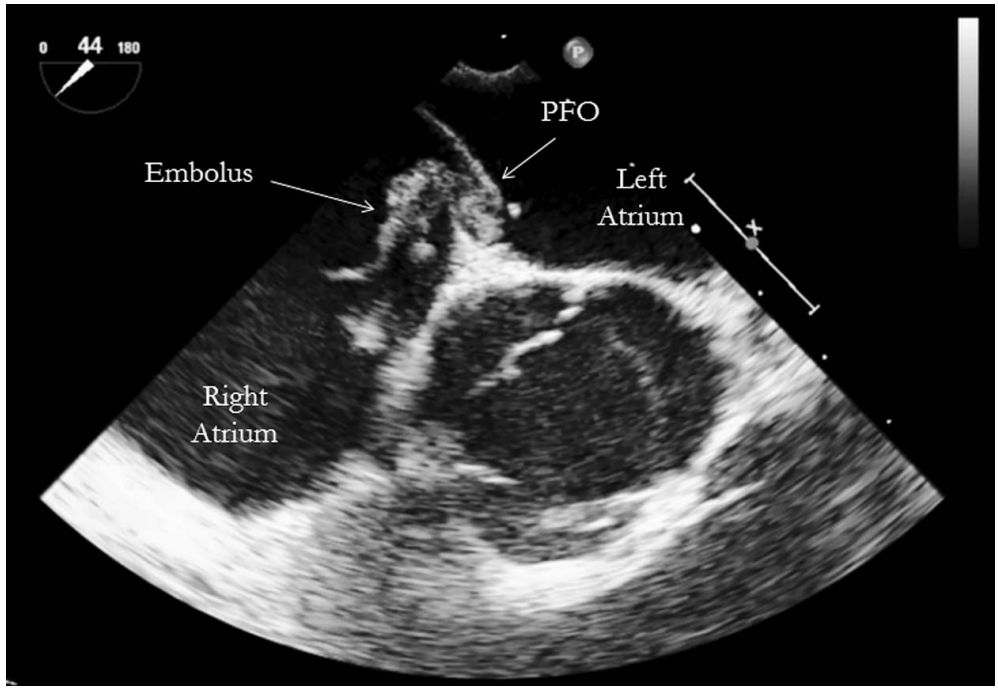

Figure 1. Short-axis echocardiographic view demonstrates a large thromboembolism-in-transit across a patent foramen ovale (PFO).

Figure 2. Intraoperative photograph of the extracted thrombus.

The published literature in thromboembolism-in-transit across a PFO is relatively recent, with the first report of echocardiographic diagnosis published in 1985.[3] A systematic review of this topic identified 174 patients during 44 years.[4] The overall mortality of an impending paradoxical embolism was 18% in the systematic review, with 66% of patients dying within 24 hours. Surgically treated patients had a nonsignificant trend toward decreased mortality. Both systemic embolism and a combined endpoint of mortality and systemic embolism were significantly decreased in surgically treated patients compared to patients treated with anticoagulation. With thrombolysis, mortality was nonsignificantly increased, and systemic embolism was significantly increased.

In their review of the history of the diagnosis and management of VT and PE, McFadden and Ochsner described the classical indication for surgical embolectomy: "persistent and refractory hypotension despite maximal pharmacological support in a patient with a clearly documented pulmonary embolus."[5]

Historically, surgical pulmonary embolectomy has been associated with a mortality rate of at least 30%, explaining the traditionally limited role of this approach.[6,7] More recently, several authors have revisited surgical embolectomy as a reasonable treatment option to improve long-term survival and to reduce chronic pulmonary hypertension. In the contemporary surgical literature, operative mortality rates have improved to $<10\%$.[8,9] Several authors have proposed expanding indications to include submassive PE with RV strain.[10,11] Greelish and colleagues demonstrated superior midterm survival up to 5 years with immediate surgical embolectomy for central thrombi compared to medical therapy.[12] Contemporary management is made more complex by the emerging role of thrombolysis and mechanical therapies.[13] However, the use of thrombolytics

has significant implications for bleeding complications, especially in the setting of a cerebral ischemic event. The true incidence of thromboembolism-in-transit may be underestimated, as echocardiography is not always performed at the time of acute PE. Given the 20%-30% incidence of PFO in the general population, we suggest adding routine echocardiography to the workup of PE to identify paradoxical emboli and to provide valuable data to identify patients who may benefit from surgical intervention with acceptable morbidity and mortality rates.

CONCLUSION

Thromboembolism-in-transit across a PFO has been considered a rare condition but one that requires urgent surgical intervention to prevent systemic embolic complications. Autopsy studies suggest that up to 30% of patients may be at risk of this entity. Routine use of echocardiography may help identify at-risk patients and may have significant consequences for early management decisions.

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