

Entrapped Thrombus in a Foramen Ovale Causing Pulmonary Emboli Treated with Emergent Surgery. Literature Review

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ABSTRACT

A 60-year-old woman was admitted due to massive bilateral pulmonary thromboembolism and entrapped thrombus in the patent foramen ovale and severe right ventricular dysfunction. The patient underwent on-pump/beating heart removal of the intracardiac thrombus and bilateral pulmonary embolectomy. The postoperative course was uneventful. The chosen surgical strategy seems to offer excellent outcome in patients with severe right ventricular dysfunction.

INTRODUCTION

The presence of a patent foramen ovale (PFO) in acute pulmonary embolism (PE) is associated with a significantly higher incidence of death [Rose 2002]. Entrapped thrombus (ET) in a PFO is a rare form of right heart thromboembolism. In-hospital mortality of thrombus-in-transit is estimated to exceed 45% [Chow 2003]. ET through the PFO was first reported in 1985 [Nellessen 1985]. Various treatments have been indicated such as anticoagulation and thrombolytic therapy, vena cava filter, percutaneous thrombectomy, and surgical embolectomy [Chow 2003; Aboyans 1998; Fauveau 2008]. We report the first case in an emerging country of ET through a PFO associated with a massive bilateral PE in which the patient underwent emergent successful surgical treatment.

CASE REPORT

A 60-year-old woman was admitted due to acute onset of exertional dyspnea associated with chest pain. She had undergone a left side total mastectomy due to breast cancer a month before. The patient presented with tachycardia, tachypnea, and a pulse oxymetry of 72% on room air. The echocardiography demonstrated an ET through a PFO (Figure 1, A). Severe right ventricular dysfunction was present with a fractional area grade of almost 14%, with a pulmonary hypertension of 75 mmHg. The contrast enhanced CT demonstrated severe bilateral PE (Figure 1, B) and a right atrial mass (Figure 1, C). The coronary angiography demonstrated a normal coronary tree.

The patient underwent on-pump/beating heart emergent bilateral pulmonary embolectomy. A bicaval and standard aortic cannulation was performed. A 6Fr extra line was extended from the aortic line to the cardioplegic cannula. The ascending aorta was clamped and the line connecting the aortic line with cardioplegic cannula was unclamped, making possible a delivery of almost 800 mL of blood per minute to the coronary arteries. The heart was maintained on sinus rhythm. The right atrium was opened, and the ET was removed. The left atrium was inspected carefully, and then closed after de-airing. The right atrium was closed. Then the main pulmonary artery was opened and extended towards the left pulmonary artery, and a 5Fr Fogarty catheter was employed to remove the thrombus. The same procedure was attempted to the right pulmonary artery through the same incision, but was unsuccessful. Then the right pulmonary artery closed to the superior cava vein was opened. The superior venous cannula was removed and repositioned on the superior caval vein, which was then detached from the right atrium. The incision on the right pulmonary artery was extended towards the right pulmonary hilus, which was opened completely, and the thrombus was removed. The embolectomy of the branches of the right pulmonary artery was performed using the same

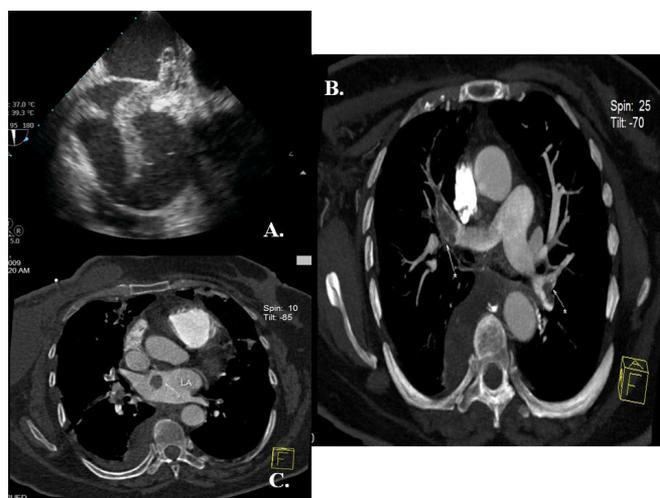


Figure 1. A, Preoperative transthoracic echocardiography demonstrating an entrapped thrombus in the foramen ovale. B, Preoperative contrast enhanced computerized tomography demonstrating massive bilateral thromboembolism. C, Preoperative contrast enhanced computerized tomography demonstrating the intracardiac thrombus.

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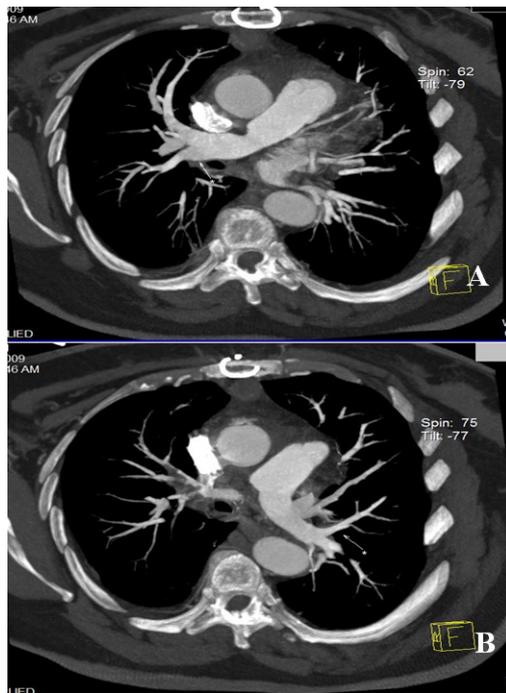


Figure 2. A, Postoperative contrast enhanced computerized tomography demonstrating total removal of the thrombus on the right pulmonary artery. B, Postoperative contrast enhanced computerized tomography demonstrating total removal of the thrombus on the left pulmonary artery.

Fogarty catheter. Then the hilus was reconstructed using an autologous pericardial patch and the right pulmonary artery was closed. The superior caval vein was then anastomosed to its usual position at the right atrium. The air was removed carefully from the heart and the aorta was declamped. At one month after surgery the contrast-enhanced CT demonstrated a normal pulmonary tree (Figure 2, A and B). At one year after surgery, the patient was still alive.

DISCUSSION

Floating right heart thrombi are uncommon and they are always associated with acute PE. ET in a PFO is extremely rare and after a careful review of the literature, we found almost 111 reported cases. The most frequently found was the PE in almost 60% of cases (Table). Conversely, isolated systemic embolus is rare. Only three cases are known [White 2003], even though echocardiography is generally performed after any stroke or distal acute ischemia. Almost 37% of cases presented with pulmonary and systemic embolism [Claver 2004]. The reason could be that a high right atrial pressure is necessary to protrude a thrombus through the inter-atrial shunt [Fauveau 2008; Auguseau 1997].

In most cases, the diagnosis was made correctly using the transthoracic echocardiography and when doubtful, the transesophageal echocardiography was employed successfully [Sattiraju 2012]. The echocardiography is the first-line diagnostic tool for ruling out valvular heart disease and diagnosing

Literature Review of the Entrapped Thrombus in a Patent Foramen Ovale

Total number of reported cases, n	111
Pulmonary embolism alone, n (%)	67 (60)
Pulmonary and paradoxical embolism, n (%)	41 (37)
Paradoxical embolism alone, n (%)	3 (3)
Localization of the paradoxical embolism	
Cerebral, n	32
Limb, n	15
Visceral, n	5
Coronary, n	4
Multiple, n	9
Male/female, n	48/63
Age, mean \pm SD, y	59 \pm 19
Risk for venous embolism, n (%)	58 (52)
Dyspnea, n (%)	85 (76.6)
Chest pain, n (%)	34 (31)
Hypoxemia, n (%)	34 (31)
Syncope, n (%)	20 (18)
Shock, n (%)	15 (13.5)
Right heart failure, n (%)	11 (10)
Cyanosis, n (%)	11 (10)
Cardiac arrest, n (%)	7 (6.3)
Pulmonary embolectomy, n (%)	30 (27)
Patients undergoing surgery/deaths, n (%)	72/7 (9.7)
Patients undergoing anticoagulation/deaths, n (%)	28/9 (32)
Patients undergoing thrombolysis/deaths, n (%)	11/4 (37)

the ET. This modality can help to determine right heart tension, pulmonary pressure, and cardiac function in cases of PE, which are important markers for choosing the right treatment option. In the presented case, we detected an ET at the PFO as a severe condition with deep venous thrombosis, and systemic embolization was prevented. A duplex scanning of abdominal and deep veins of legs could have also been recommended, especially to examine the possibility of placing an inferior caval filter or clip. It is prudent to perform a first-line CT to assess for the presence of PE.

The best management is still controversial. Three therapeutic options can be discussed. ET can be removed surgically or be dissolved by thrombolytics and/or anticoagulation. Almost 65% of the patients underwent surgery and the mortality was 9.7% versus 36% and 32% mortality in patients undergoing thrombolysis [Hust 1995] or anticoagulation [Bezgin 2010]. Theoretically, thrombolysis or even anticoagulation seems hazardous in great and mobile intracardiac thrombi with an important risk of either fragmentation or complete embolization. Moreover, the deep vein thrombosis can also be a source of recurrent embolism. Conversely, the delay between clinical presentation and echographic diagnosis

can be extremely variable, from 1 hour to a few weeks. In the cases with long delays, the efficacy of thrombolytics or anticoagulants might be more hypothetical on an old thrombus.

In our case, we preferred surgery even though we were aware of the risks of cardiac surgery, as the patient suffered cardiac failure. This therapeutic choice seemed to be more rapid and complete and the PFO would be closed at the same time [Ooi 2010]. No embolization after surgical thrombus removal is reported. In our case we modified the usual employed technique. Due to severe right ventricular dysfunction, we preferred on-pump beating open heart surgery, which permitted the ET removal and also the pulmonary embolectomy. Such a technique has been reported in the treatment of ischemic heart disease [Prifti 2000] and mitral valve disease [Prifti 2003] in patients with low left ventricular ejection fraction.

We conclude that the type of chosen surgical technique consisting in on-pump/beating open heart surgery is a unique procedure reported in the treatment of an acute PE and ET in a PFO.

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