

Pulmonary Thromboembolism Associated with Paradoxical Embolism in a Patient with Patent Foramen Ovale

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Introduction

Patent foramen ovale (PFO) is a pathological condition characterized by an opening in the interatrial septum, that allows blood to flow from one atrium to the other. It is found in approximately 25% of the adult population, with no hemodynamic implications in most cases.¹ However, due to persistence of the foramen, paradoxical embolism may occur as a cause of ischemic events; in some cases, closure of the PFO is indicated as a secondary prevention strategy for thromboembolic events.²

Studies have demonstrated an association between PFO and many clinical conditions, some potentially severe, such as ischemic stroke and pulmonary thromboembolism (PTE).³

Although paradoxical embolism is a well-documented consequence of PFO, the passage of blood clot through the PFO has been little documented in the literature.^{3,4} Thus, the present study aimed to report a typical case of PTE associated with paradoxical embolism probably caused by PFO.

Clinical case

A 58-year-old male patient urgently admitted with severe dyspnea, which started about one week before, and got worse within the last hours before admission. The patient reported no other comorbidities.

The patient underwent computed tomography angiography of the chest, with a PTE protocol, which revealed bilateral PTE (Figure 1).

During hospitalization, the patient had abdominal pain; an abdominal magnetic resonance imaging was performed, which revealed splenic artery embolism, areas of multifocal infarcts, and absence of aortic lesions that may explain the embolism (Figure 2).

Full anticoagulation therapy with low molecular weight heparin was then initiated. In light of both arterial

and venous thromboembolic events, transesophageal echocardiogram (TEE) was performed and revealed lipomatous interatrial septum, with bulging of the fossa ovalis region into the left right atrium, associated with delamination, with no evidence of interatrial tunnel or prominent Eustachian valve. Aired saline solution was infused, and right-to-left flow through the fossa ovalis was then observed (Figure 3).

The patient was regularly followed-up by the cardiology and vascular surgery staff. After excluding the presence of hematological disease, a percutaneous closure device was used to close the PFO (Figure 4).

Following device implantation, transthoracic echocardiogram confirmed complete closure of the PFO, with no residual flow. The patient was discharged with anticoagulation therapy and regular follow-up by the cardiology and vascular surgery staff.

Discussion

The presence of foramen ovale is essential in fetal life as it allows oxygenated blood to flow directly to systemic circulation, bypassing the lungs which are collapsed in this stage of life. However, with lung expansion at birth, fusion of the septa and closure of the foramen ovale occur around the first month of life. Nonetheless, in nearly 25% of the general population, complete closure of the foramen ovale does not occur, and it either remains patent throughout life or closes at first and then open in situations of right pressure overload.³

PFO may be diagnosed in association with PTE, and the concomitant presence of these both conditions is associated with systemic paradoxical embolism and greater severity of disease.⁴ In patients with acute pulmonary embolism, right atrial pressure is increased, with elevates the risk of blood flow from the right to the left atrium through the PFO and thus potentially the risk of paradoxical embolism. Many prospective and retrospective observational studies have shown a high prevalence of stroke in patients with acute pulmonary embolism, and a disproportionately high prevalence of PFO among patients with acute pulmonary embolism who had a stroke.⁵ In this case reported, the patient had PTE and probably progressed to systemic paradoxical embolism. Although the passage of the thrombus through the PFO could not be visualized, this was a potential causal factor based on the echocardiographic findings.

The foramen ovale can be defined as a risk factor for embolic events when it has specific echocardiographic features that become important in the therapeutic decision-making process.⁶ Some characteristics of the PFO are associated with paradoxical

Palavras-chave

Pulmonary Embolism; Splenic Infarction; Foramen Ovale; Paradoxical Embolism.

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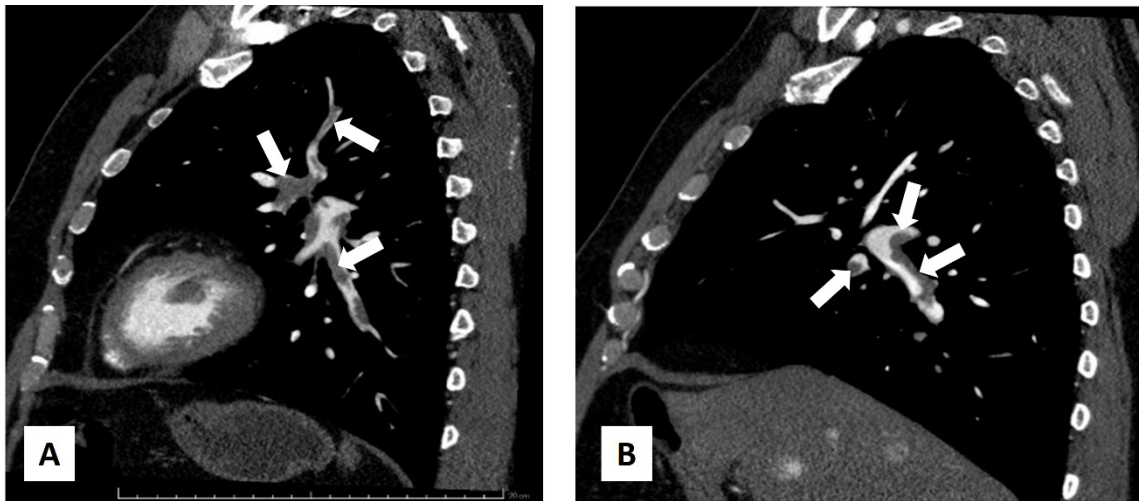


Figure 1 – Sagittal sections of computed angiography showing several intraluminal filling defects in segmental and subsegmental branches of main pulmonary arteries (some of them indicated by white arrows), indicating bilateral PTE; A. left lung; B. right lung (arrows).

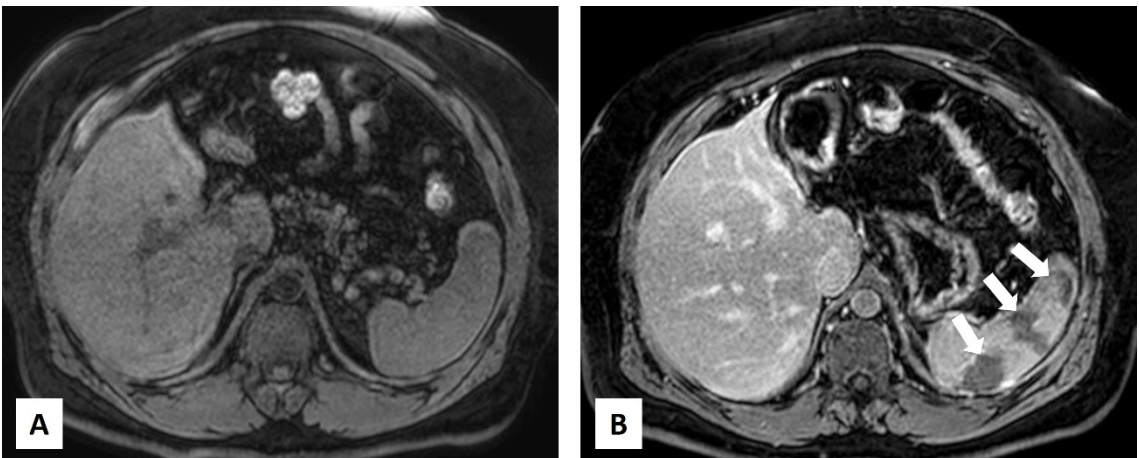


Figure 2 – T1 weighted axial magnetic resonance image, with fat suppression before (A) and after (B) administration of paramagnetic contrast, which showed low uptake of the contrast (white arrows), compatible with areas of splenic infarction.

embolism, including a long-tunnel PFO, hypermobile interatrial septum, prominent Eustachian valve or Chiari's network, a large right-to-left shunt during Valsalva maneuver, and a low angle between the PFO and the inferior vena cava. When two or more of these characteristics are detected by TEE, there is a strong association of PFO with thromboembolic events and therefore these patients will benefit from the PFO closure.⁷

The therapy adopted in the report was initially applied with the use of anticoagulant drugs and, later, percutaneous closure of the PFO, as already proposed by some studies.⁸

Paradoxical embolism with involvement of the splenic artery and association with pulmonary embolism implies the need for

diagnostic investigation for a source of embolism, such as the interatrial shunt. In these circumstances, closure of the interatrial sept defect should be considered, in view of echocardiographic characteristics, in addition to a multidisciplinary approach on the anticoagulant therapy, aiming at preventing new thromboembolic events.

Author Contributions

Conception and design of the research: Vidal ABV; acquisition of data: Vidal ABV, Silva DB, Peres ARM, de Souza RL; analysis and interpretation of the data: Vidal ABV, Silva DB, Peres ARM, de Souza RL, Amorelli CES, Campedelli FL, Alves

Case Report

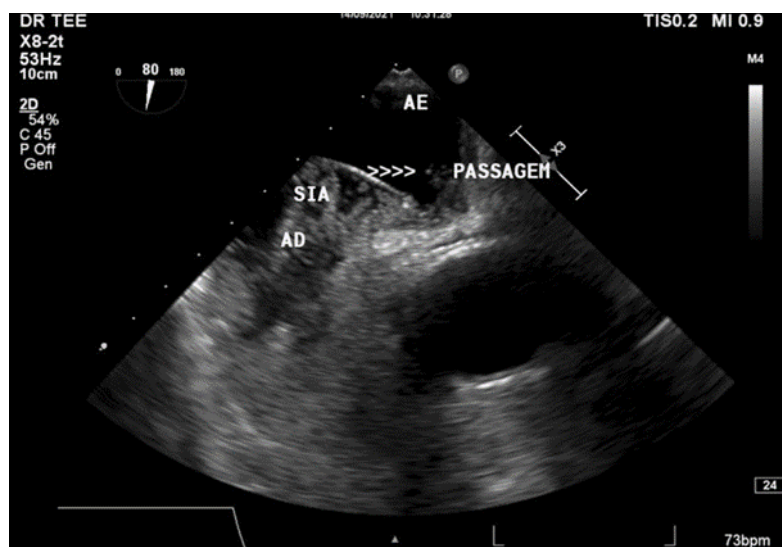


Figure 3 – TEE (80°) showing passage of microbubbles (arrows), confirming the presence of PFO. LA: left atrium; RA: right atrium; IAS: interatrial septum.

LM, de Oliveira FAC; writing of the manuscript: Vidal ABV, Silva DB; critical revision of the manuscript for intellectual content: Amorelli CES, Campedelli FL, Alves LM, de Oliveira FAC.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any thesis or dissertation work.

Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

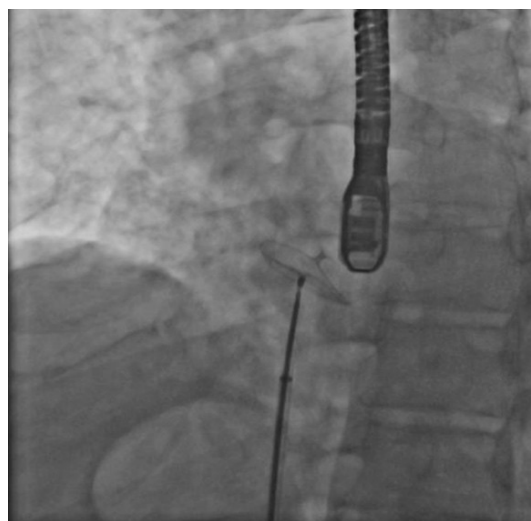


Figure 4 – Implantation of a percutaneous closure device for PFO closure.

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