CASE REPORT

Mitral valve thrombus, embolic events, carotid artery stenosis and patent foramen ovale

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Abstract

Patent foramen ovale (PFO) is associated with high prevalence of stroke and systemic embolisation. A 53-year-old man had mitral valve thrombus and PFO diagnosed by echocardiography, in addition to carotid artery stenosis and embolic events including transient ischemia attack, retinal artery occlusion and left kidney infarct. Surgical removal of the mitral valve thrombus and concomitant coronary artery bypass were performed under cardiopulmonary bypass. We believe this is the sole reported case of mitral valve thrombus associated with a PFO. Due to their embolic potential, concomitant PFOs should be closed during heart operations, and independent ones deserve interventional management in high-risk patients.
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Key words: carotid artery stenosis, embolic events, kidney infarct, mitral valve thrombus, patent foramen ovale, retinal artery occlusion, transient ischemia attack

Introduction

Patent foramen ovale (PFO) is a hemodynamically insignificant interatrial communication, detected in 20–35% of autopsies and in 10–26% of living individuals by contrast transesophageal echocardiography [1]. Omniplane transducers of transesophageal echocardiography permit direct visualization of the separation of the septum primum and septum secondum [1]. Studies have revealed PFO might be associated with stroke and systemic embolisation [2]. A high PFO prevalence has been noted in the stroke population [3]. In the present case, PFO was a causative factor responsible for the embolic events and for mitral valve thrombus formation.

Case report

A 53-year-old man complained of lumbago on the left for 2 weeks, and was diagnosed as a left kidney infarct in the local hospital on 18 December 2007. He was afebrile. Echocardiography as part of screening for a cardiac source of embolism demonstrated a moderate sized (13 mm in diameter) vegetation attached to the posterior mitral valve leaflet, and a right-to-left shunting at the atrial level was revealed by Doppler and agitated saline contrast, suggestive of a mitral valve myxoma and PFO. There was no evidence of left atrial or left appendage thrombus, atrial arrhythmia, infective endocarditis or aortic arch atheroma. He was thus transferred to our hospital for surgical treatment on the same day. He presented significant diabetes mellitus type 2, hypertension, hyperlipidemia and osteoporosis. About 2 years earlier at the end of February 2006, he developed transient ischemia attack on the left, manifesting with transient left eye blindness, which cleared up after a few hours. He was referred to the local hospital and was diagnosed with carotid artery stenosis and central retina artery occlusion. On the second day he was managed with carotid artery stenting.
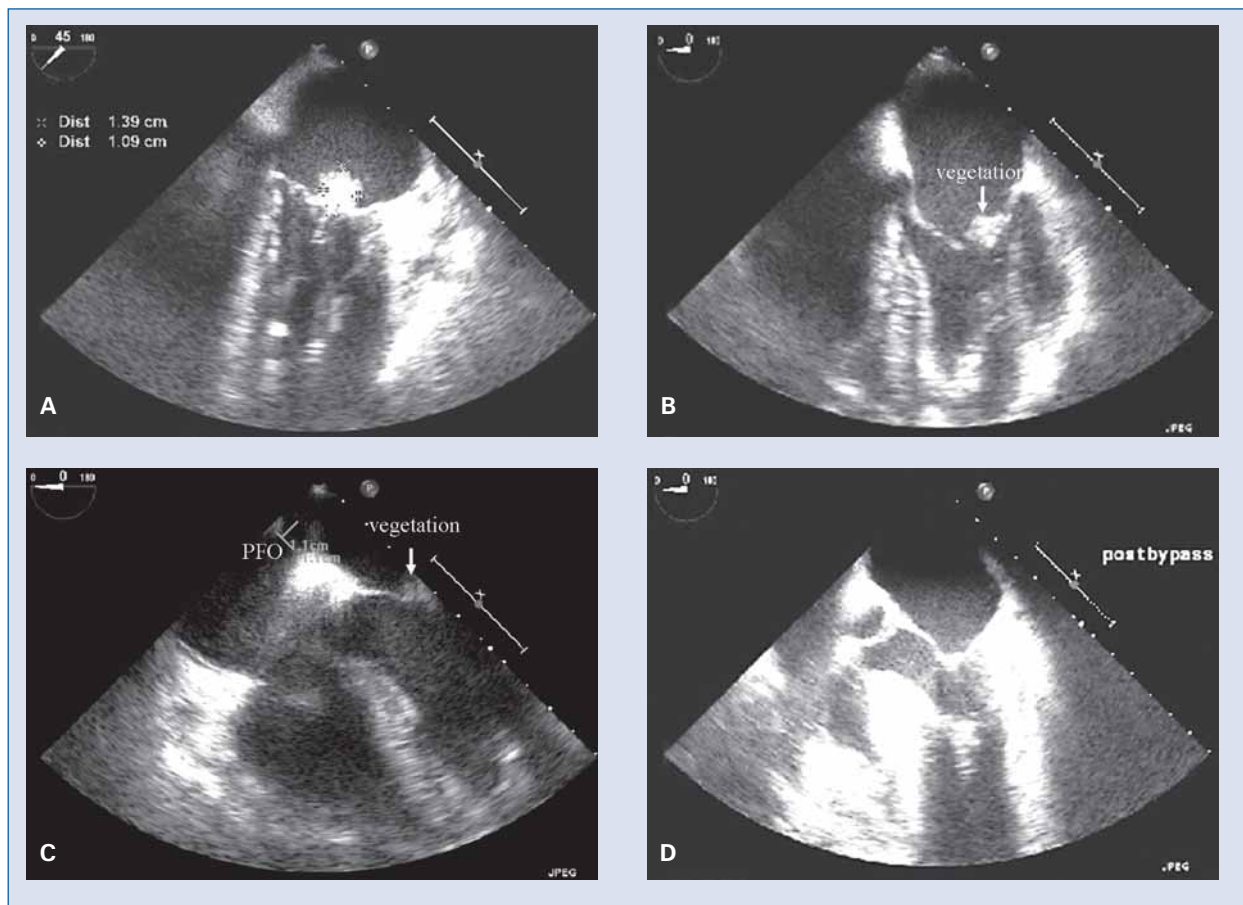
Figure 1. Intraoperative transesophageal echocardiography showed (**A**) a mobile, highly friable vegetation measuring 1.39 × 1.09 cm attached to the atrial aspect of the posterior mitral valve leaflet, (**B**) prolapsed into the left ventricle during diastole, (**C**) patent foramen ovale (PFO) extending 1.1 cm in diameter, with a maximal movement of 1.1 cm, and (**D**) a clear mitral valve of post-bypass.

On admission, his temperature was 37.4°C, pulse 88/min, respiration 18/min and blood pressure 154/91 mm Hg. An apical systolic murmur of grade 2/6 was audible. Laboratory tests showed a normal blood count and normal hematological parameters. His blood sedimentation rate was 78 mm/hour (normal: 0–20 mm/h). His electrocardiogram was normal. Routine catheterization showed the marginal branch and right coronary artery severely stenosed.

An operation was performed on the same day when he was referred to this hospital. Intraoperative transesophageal echocardiography showed a mobile, highly friable, cotton wadding-like vegetation measuring 1.39 × 1.09 cm, of a changeable form with cardiac circle, attached to the atrial aspect of the posterior mitral valve leaflet, with trivial mitral valve regurgitation. There was no intracardiac thrombus, mitral valve prolapse or mitral annulus calcification. Foreman ovale was patent extending 1.1 cm in diameter, with a maximal rightward movement of 1.1 cm (Fig. 1A–1C).

The operation was carried out under standard cardiopulmonary bypass. Coronary artery bypass was performed with an *in situ* semi-skeletonized left internal mammary artery bypassed to the marginal branch, and a saphenous vein graft to the right coronary artery. A left atriotomy was made, and a dark brown, opaque, dense, non-gelatinous, multilobulated, multifronded vegetation 1.4 × 1.1 × 0.8 cm in size was noted to be originated with a broad base from the atrial aspect of the P_2 portion of the mitral valve leaflet near the edge of the cusp. The vegetation was removed without damaging the function of the mitral valve leaflet. Careful inspection of intracardiac cavities revealed no additional mass lesions. No evidence of mitral regurgitation was noted by saline injection test. The foramen ovale was patent 4 mm in diameter under direct vision, which was closed by direct suture. Postbypass transesophageal echocardiography illustrated a clear posterior mitral leaflet, and a completely closed foramen ovale (Fig. 1D).

His postoperative serum creatinine (23 December 2007) was 1.68 mg/dL. He was doing well and was discharged on the 6th postoperative day. His serum creatinine was normal at 4-week follow-up.

The gross sample from the posterior leaflet of the mitral valve measured $1 \times 0.8 \times 0.8$ cm in size. Microscopic inspection revealed fragments of fibrinous material and small areas of fibromyxoid tissue.

Discussion

The PFOs with ≥ 2 mm separation of the septum primum and secondum were defined as large [4]. Morphologic studies on PFO showed that its size averaged 4.9 (range, 1–19) mm, which was considered large enough for emboli to pass through and to occlude the cerebral artery [2].

The mechanisms of the occurrence of stroke in the PFO population remain unclear. A stagnant flow might occur with PFO, and it might be susceptible to atrial arrhythmias with possible intra-atrial thrombus formation [5]. A more severe right-to-left shunt and large opening of the PFO have been identified as the main characteristics in stroke patients with paradoxical embolism. Right-to-left shunt at rest without evidence of significant right atrial pressure was a marker of risk for cerebral ischemia in patients with PFO who might have increased exposure to paradoxical emboli [2]. A multicenter perspective study showed that patients with larger PFOs were associated with cryptogenic stroke and high prevalence of deep venous thrombus [4].

Irrespective of antiphospholipid syndrome, mitral valve thrombi might be formed in the presence of mitral valve calcification, mitral valve prolapse, atrial fibrillation or infective endocarditis. Of these, mitral valve calcification may serve as a nidus for thrombus formation, leading to embolic stroke [6]. Mitral valve prolapse might have an impact on coagulation with increased thrombin generation instead of on systemic platelet activation [7]. The role that platelet coagulant hyperactivity played in the pathogenesis of thromboembolism in patients with mitral valve regurgitation has been drawn as a conclusion by some authors [8].

Hashimoto et al. [9] reported one case of mitral valve thrombus in a patient with intact mitral valve, and the etiology was unclear. In comparison, the present patient had a large PFO, which was associated with the embolic events of cerebral, retinal and renal arteries, and was responsible for the formation of the valvular thrombus as well. Tice et al. [10] defined mitral valve strands as thin (< 1 mm in width), highly mobile, filamentous projections atta-

ched to the atrial surface of the mitral leaflets. The vegetation of this patient outranged the concept of a mitral valve strand, and hence was diagnosed as a thrombus formation. Moreover, the differentiation diagnosis from myxoma lay in a non-nebulous nature shown on echocardiography, a non-gelatinous appearance on the gross sample, and an eventual fibrinous change confirmed by histological examination.

Emboli from within the heart are recognized as a source of stroke, especially in young patients. There was an 11% overall incidence of an associated intracardiac mass presumed to be responsible for the neurological symptoms [11]. Intracardiac thrombi are usually larger than 2 cm [12]. The thrombus may be denser than the adjacent myocardium with an akinetic or aneurysmal segment of myocardium on echocardiography. Vegetation, tumour or calcified deposit on a cardiac valve should be considered in differential diagnosis as they usually share constitutional presentations such as fever, weight loss, and fatigue, etc. with an increased sedimentation rate, and may lead to mitral valve regurgitation and require surgical intervention. The location, size, origin, shape and motion of the mass were important in determining the nature of the lesion [11].

Multiple transient ischemic attacks and stroke can be the result of a cardiac tumour, most commonly papillary fibroelastomas. The majority of these common valve tumours morphologically resemble a sea anemone with multiple papillary fronds [13], usually originating from the mid portion of the valve, smaller than 1 cm in diameter and pedicled by a stalk with high mobility through the cardiac circle [14]. Mitral valve myxomas may occur on the anterior or posterior mitral leaflet or the mitral annulus, and can lead to embolisation, transient ischemic attack and stroke, caused by the tumour fragments or thrombotic material on the myxoma of the mitral leaflet [15]. Embolic events are frequent, life-threatening complications of infective endocarditis, accounting for 26% of the patient population [16, 17]. Both the size and mobility of the vegetations were related to the incidence of embolic events. Patients with vegetations > 10 mm had a 60% incidence of emboli. Patients with severely mobile vegetations > 15 mm had an 83% incidence and were at greatest risk [18].

Carotid artery stenosis may be associated with other arterial lesions such as coronary and peripheral arterial disease, and other vascular risk factors such as hypertension, diabetes mellitus, hyperlipidemia and smoking [19]. In selected asymptomatic

patients referred for percutaneous PFO closure, incidental coronary angiography disclosed a prevalence of 29% clinically unsuspected coronary artery disease, with 9% ≥ 50% diameter stenoses, 5% one-vessel, 2% two-vessel and 2% three-vessel disease [20]. The role of carotid artery stenosis in the pathogenesis of ischemic stroke has been known for centuries. The growth of the plaques and the subsequent disintegration and ulceration might be an explanation for ischemic stroke [19].

In the present patient, PFO and/or carotid artery stenosis might predispose stroke and systemic embolic events. Meanwhile, it cannot be completely excluded that stroke was a sequela of coronary artery disease or the mitral valve thrombus itself. However, PFO and carotid artery stenosis were alternatively the favoured causative pathologies of the thrombus formation, with the former being a possible predisposing factor of the embolic events on the left side. This is the unique reported case of a mitral valve thrombus associated with a PFO.

Due to their embolic potential, concomitant PFOs should be closed during heart operations, and independent ones deserve interventional treatment in high risk patients. Carotid artery stenosis ought to be surgically or interventionally managed as well.

Acknowledgements

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