Clinical Spotlight

Right Ventricular Thrombus Detection and Multimodality Imaging Using Contrast Echocardiography and Cardiac Magnetic Resonance Imaging

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We present the case of right ventricular thrombus formation associated with a right ventricular infarct secondary to a proximal right coronary artery thrombus, which was not evident on transthoracic echocardiography but detected on both delayed gadolinium enhanced magnetic resonance imaging and microsphere contrast echocardiography. The diagnosis of right ventricular thrombosis altered the decision to place an implantable cardiac defibrillator in this patient. Anticoagulation with warfarin resulted in resolution of the thrombus. This case highlights the utility of multimodality imaging in the detection and follow-up of right ventricular thrombus in the setting of right ventricular myocardial infarction, and the effectiveness of anticoagulation therapy.

(Heart, Lung and Circulation 2012;21:185–188)

Keywords. Right ventricular thrombus; Contrast echocardiography; Magnetic resonance imaging; Diagnostic imaging; Myocardial infarction

Introduction

Isolated right ventricular (RV) thrombus formation occurs infrequently and the true incidence is not clearly known. RV thrombosis may occur secondary to intracardiac procedures [1] and severe pulmonary embolisation [2], but uncommonly in the setting of a RV infarction [3]. Echocardiographic documentation of RV thrombus in association with acute myocardial infarction was first described in 1983 [4]. More recently, the use of contrast-enhanced magnetic resonance imaging (MRI) and contrast echocardiography have shown benefit in the identification of intracardiac thrombus [5,6].

We report a case of RV thrombus formation in a patient with a proximal right coronary artery (RCA) occlusion and RV infarction that was not evident on transthoracic echocardiography (TTE) but detected on both cardiac MRI and contrast echocardiography. This diagnosis resulted in the delayed insertion of an implantable cardiac defibrillator (ICD) until the patient was anticoagulated with resolution of the thrombus.

Case Report

A 45 year-old male was admitted with a clinical and electrocardiograph diagnosis of a delayed (up to 48 hours) presentation infero-posterior ST elevation myocardial infarction. Peak troponin was 4.80 μg/L. Initial TTE on arrival demonstrated a left ventricular ejection fraction (LVEF) of 40%, mild RV systolic dysfunction and infero-posterior akinesis.

Coronary angiography revealed a thrombotic occlusion of the proximal RCA and mild-to-moderate coronary atherosclerotic disease in the left anterior descending artery and first obtuse marginal branch. Primary percutaneous coronary intervention with a 4.5 mm × 24 mm bare metal stent (Liberte^{TM}, Boston Scientific) to his RCA was performed. Thrombectomy was attempted but embolisation to the distal RCA occurred with poor distal perfusion. Thrombolysis in Myocardial Infarction (TIMI) flow improved from grade zero to two.

Two days later, the patient had an episode of ventricular tachycardia secondary to acute RCA stent thrombosis from which he was successfully cardioverted but remained haemodynamically unstable. Repeat percutaneous coronary intervention was unsuccessful. Transthoracic echocardiography revealed moderately impaired RV systolic function and a reduction in LVEF to 25%. An

Received 13 August 2010; received in revised form 22 April 2011; accepted 22 August 2011; available online 15 September 2011

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1443-9506/04/$36.00
doi:10.1016/j.hlc.2011.08.012

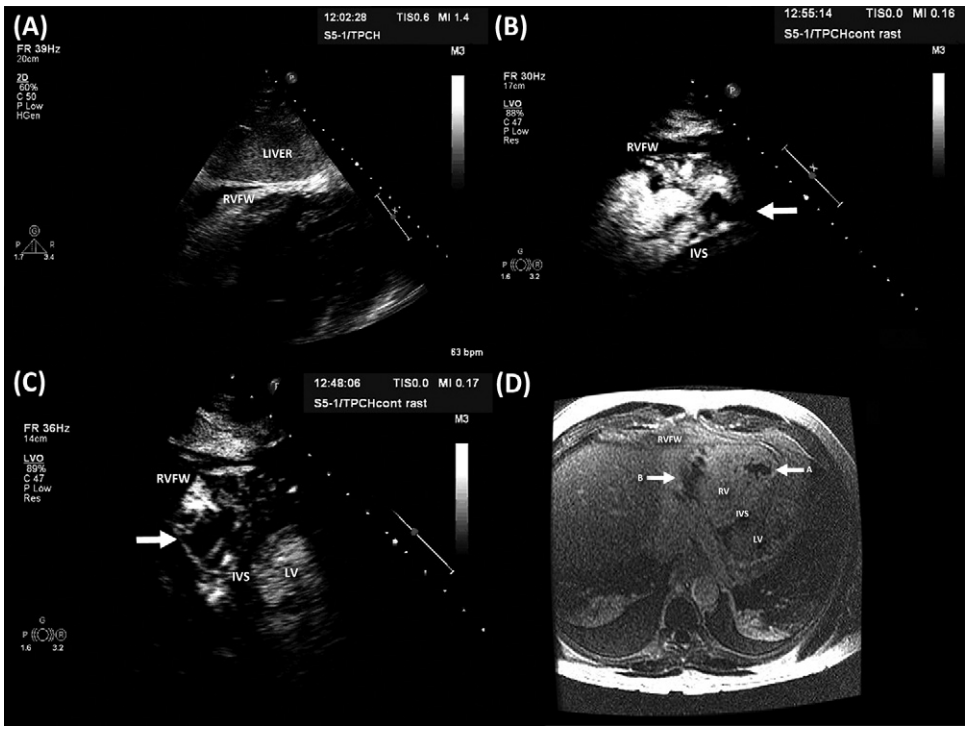

Figure 1. *(A) Unenhanced transthoracic echocardiography, subcostal view, with no demonstration of right ventricular thrombus; (B) contrast-enhanced transthoracic echocardiography, subcostal long-axis view, clearly demonstrating the presence of an apical right ventricular thrombus; (C) contrast-enhanced transthoracic echocardiography, subcostal short-axis view, clearly demonstrating a right ventricular apical thrombus; (D) delayed gadolinium enhanced magnetic resonance imaging, four-chamber view, clearly demonstrating the presence of both right ventricular apical and basal free-wall thrombus. (Legends: thick arrow head = right ventricular thrombus; arrow head A = apical thrombus; arrow head B = basal free wall thrombus; IVS = interventricular septum; LV = left ventricle; RV = right ventricle; RVFW = right ventricular free wall.)*

intra-aortic balloon pump was inserted for cardiogenic shock. Intravenous heparin, eptifibatide, dobutamine, frusemide and amiodarone with oral aspirin and clopidogrel were administered.

The repeat TTE did not reveal any LV or RV thrombus (Fig. 1A). Delayed gadolinium enhanced cardiac MRI (Fig. 1D) performed for viability assessment four days later, revealed lateral and posterior RV free wall full thickness infarction and postero-lateral left ventricular (LV) infarction with two large RV thrombi (16 mm free wall, 18 mm apex). Transthoracic echocardiography coupled with the administration of the intravenous microsphere contrast Definity^{TM} (Lantheus Medical Imaging Inc.) was performed the following day to aid in visualisation of the wall motion abnormalities and thrombi. This confirmed the two RV thrombi within the RV apex and at the basal RV free wall, severe RV systolic dysfunction and a LVEF of 30% (Fig. 1B and C). Anticoagulation with warfarin was initiated and the patient made an uncomplicated recovery. Insertion of ICD for ischaemic cardiomyopathy was delayed for six months. A follow-up contrast TTE two months later revealed resolution of the RV thrombus but persisting severe LV and RV systolic dysfunction.

Discussion

This case demonstrates the difficult diagnosis and imaging of RV thrombus associated with RV infarction. Unenhanced TTE failed to detect the RV thrombus due to location within the RV apex and basal wall adjacent to the tricuspid valve. However both cardiac MRI and contrast TTE detected the presence of RV thrombus formation. The implantation of an ICD was delayed and the thrombus resolved with anticoagulation.

Two-dimensional TTE and transoesophageal echocardiography (TOE) are the most common imaging modalities for the detection and monitoring of RV thrombus [3,7]. Post-infarct RV thrombi detected by TTE and subsequently confirmed surgically [1,3] or at autopsy [8] have been described. In the diagnosis of the more common LV thrombi, TOE has a sensitivity of 88% and specificity of 99% [5], and TTE has a sensitivity of 95% and specificity of 86% [9]. TOE is considered an appropriate test for the detection of thrombus according to American Society of Echocardiography (ASE) guidelines. We did not perform a TOE in our patient due to the invasive nature of the procedure, and the diagnosis being made with cardiac MRI and confirmed by non-invasive transthoracic contrast echocardiography.

Contrast echocardiography utilises contrast microspheres coupled with contrast-specific ultrasound imaging modalities. These intravenous echocardiographic contrast agents are microspheres consisting of an outer shell and inner gaseous core (such as the inert high molecular weight gas, octafluoropropane) [10]. By exploiting the differential oscillating properties of myocardium and