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Case Report

Cardiac metastatic melanoma: Imaging diagnostic clues

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ABSTRACT

A 47-year-old male was admitted to hospital for severe pericardial effusion; he had undergone surgical removal of cutaneous melanoma 10 years before. Echocardiography-guided pericardiocentesis revealed the presence of intramyocardial masses, which were better defined and characterized, together with pericardial involvement, by cardiac magnetic resonance. Pericardial fluid drained was negative for malignant cells, so video-assisted thoracoscopy was performed and pathologic tissue was biopsied, leading to the diagnosis of metastatic melanoma. Multidisciplinary approach and multimodality imaging played a key role in allowing the diagnostic workup in this complex case.
<**Learning objective:** The diagnosis of cardiac metastases is challenging and histologic characterization is necessary to guide therapy. Multimodality imaging and minimally invasive thoracoscopy are key tools to achieve these goals.>

Introduction

Cardiac metastases often remain silent, being an autoptic finding; when symptomatic they can mimic all forms of cardiac disease, ranging from dyspnea, to atrial and ventricular arrhythmias, to chest pain, and represent an insidious diagnostic challenge. Melanoma is the solid tumor with the highest propensity to hematogenous spread to the heart. The integration of cardiac imaging modalities with multidisciplinary approach is the prominent feature in managing complex cases with both systemic and cardiac neoplastic involvement. Minimally invasive thoracoscopy can allow biopsy of cardiac masses, thus permitting histologic diagnosis and therapy planning.

Case report

A 47-year-old male was admitted to hospital for worsening dyspnea. Ten years earlier he had undergone surgical removal of cutaneous melanoma of the dorsal region, with lymphadenectomy; regular follow-up had been negative for disease recurrence. At hospital admission, electrocardiogram (ECG) showed sinus tachycardia with normal atrioventricular (A-V) conduction, QRS voltage tended to be low and diffuse repolarization abnormalities were present (Fig. 1, Panel A). Echocardiography revealed severe pericardial effusion, with initial signs of ventricular filling impairment; pericardiocentesis evacuated 1600 ml of citrine-yellow pericardial fluid, negative for malignant cells. Moderate pericardial effusion persisted, and lateral and inferolateral wall thickening was detected at echocardiography (Fig. 2, Panels A and B); a mass of 2 cm was seen on the right side of the interatrial septum (Fig. 2, Panels C and D). Cardiac magnetic resonance (CMR) showed diffuse thickening of the left ventricle, more pronounced on the lateral side (Fig. 3, Panel A) and inferolateral walls. Pathologic myocardial segments showed inhomogeneous, hyper-intense signals both on STIR-T2 and on T1 images (Fig. 3, Panels B and C), and were perfused at first-pass contrast injection and enhanced inhomogeneously (Fig. 3, Panel D). The coronary sinus was occupied by pathologic solid tissue, protruding for 2 cm in the right atrium beside the interatrial septum and sharing the same signal characteristics of the masses infiltrating ventricular myocardium (Fig. 3, Panels A–D). Multiple solid tissue nodules were identified on the parietal pericardium. Severe pericardial effusion was present (Fig. 3, Panel A), with initial signs of hemodynamic relevance. A pericardial window was created via video-assisted thoracoscopy; multiple biopsies of pericardial

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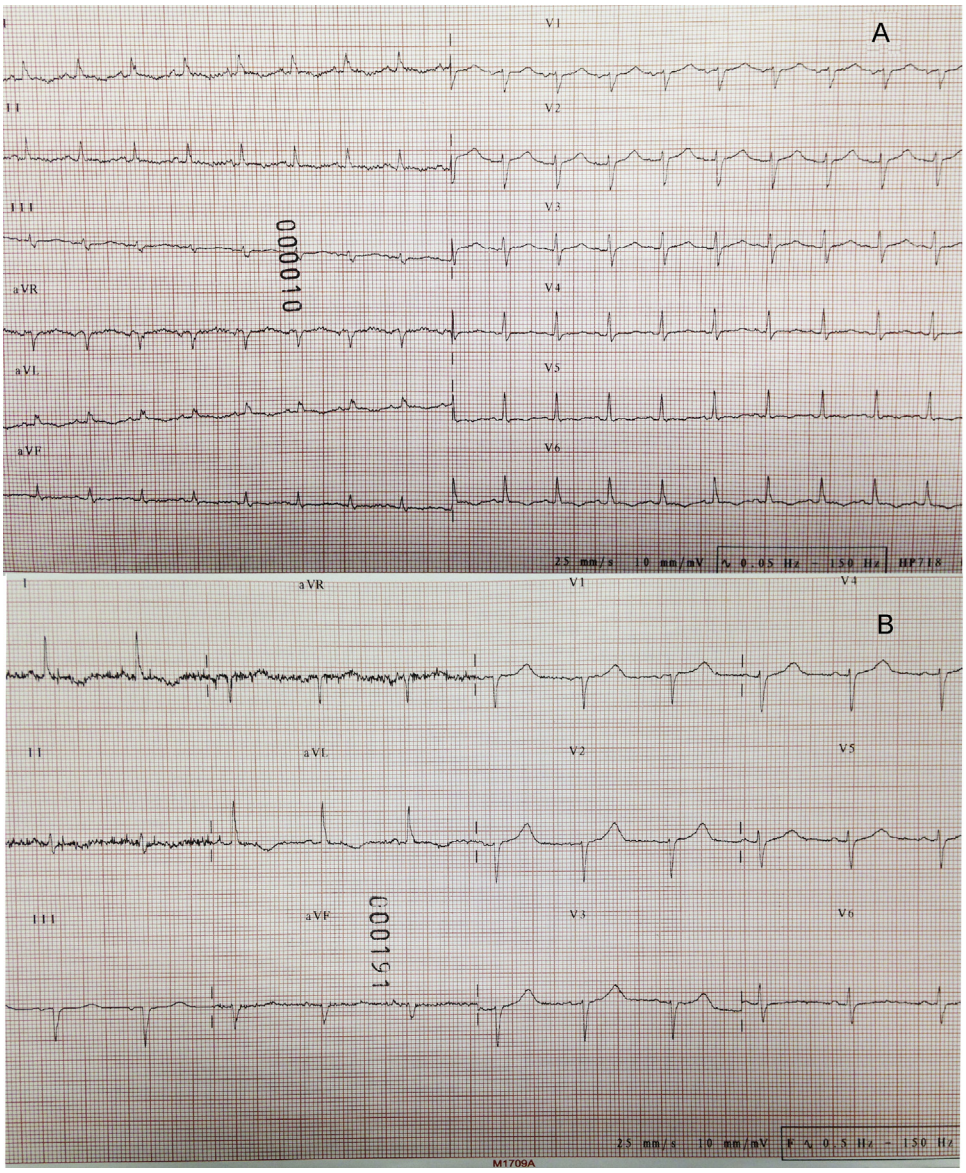

Fig. 1. Panel A: electrocardiogram (ECG) at admission, showing sinus tachycardia, with normal atrioventricular (A-V) conduction, low QRS voltage and diffuse repolarization abnormalities. Panel B: ECG at discharge, showing sinus rhythm with normal A-V conduction. QRS voltage had improved, although lack of progression of the R wave in the precordial leads is more evident compared to admittance ECG; some abnormalities of repolarization were still present.

nodules (Supplementary video) were performed and a drain was left in situ. Total body computed tomography (CT) scan showed small pulmonary nodules. A cutaneous lesion was noticed on the head and biopsied. Histologic examination of both the cutaneous mass and the pericardial nodules revealed epithelioid cell-type melanoma, showing BRAF mutation (B-Raf proto-oncogene, serine/threonine kinase); the cutaneous lesion was judged as metastatic. BRAF mutation is frequently found in melanoma and specific therapy with oral vemurafenib, a small molecular inhibitor, has proven effective in advanced (stage 4) BRAF-mutant melanoma [1]. Therapy with vemurafenib was started and well tolerated. ECG monitoring during hospital stay did not reveal any significant arrhythmias. ECG at discharge showed sinus rhythm with normal A-V conduction. QRS voltage had improved, although lack of progression of the R wave in the precordial leads was more evident compared to admittance ECG; some abnormalities of repolarization were still present (Fig. 1, Panel B).

Discussion

Malignant melanomas represent the tumors with the highest rate of cardiac involvement [2]. Cardiac metastases usually remain silent; when symptomatic, they can mimic all forms of cardiac disease, ranging from dyspnea, to atrial and ventricular arrhythmias, to chest pain [3]. The first sign of cardiac involvement can be cardiac tamponade. Imaging has a pivotal role in better defining location, extension, and hemodynamic consequences of cardiac metastases. Echocardiography detects myocardial and pericardial masses and pericardial effusion; its role in the emergency setting of cardiac tamponade is well established [2] while it cannot unequivocally establish the nature of cardiac masses or pericardial effusion. CMR allows comprehensive evaluation of the heart muscle, pericardium and surrounding organs; its capacity of tissue characterization permits the identification of pathologic tissue within the cardiac muscle and pericardium [4]. First-pass perfusion imaging and

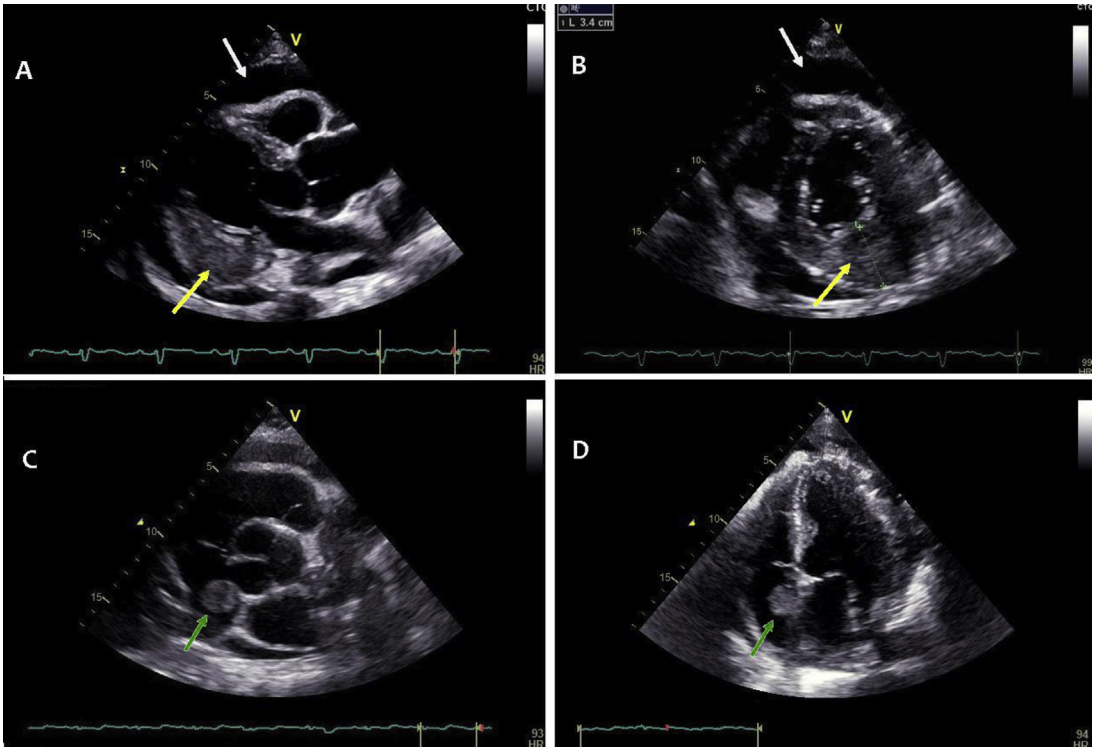

Fig. 2. Panels A and B: parasternal view (long and short axis): left ventricular lateral and inferolateral mid and basal wall thickening (3.4 cm; lower arrow); pericardial effusion (upper arrow). Panels C and D: parasternal view (aortic plane) and four-chamber view: round mass protruding on the right side of the interatrial septum (arrow).

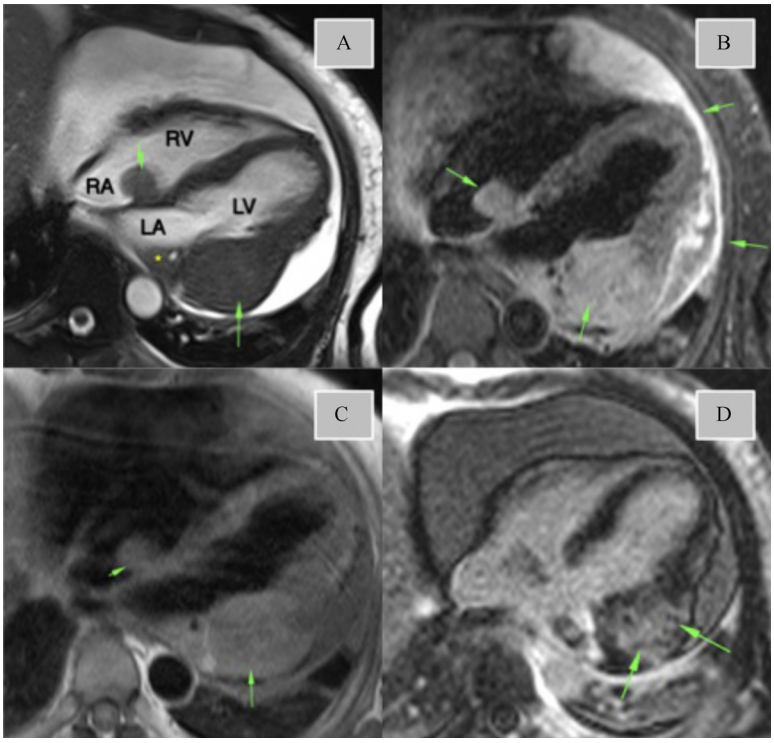

Fig. 3. Four-chamber off-axis view, end-diastolic phase. Panel A: cine image. Thickening of the lateral basal wall (long arrow) of the left ventricle; mass protruding in the right atrium, in proximity of the interatrial septum (short arrow); the coronary sinus is entirely occupied by pathologic tissue (asterisk); severe pericardial effusion. Panel B: STIR T2-weighted image, showing inhomogeneously hyperintense signal of the pathologic masses and hyperintense signal of the pericardium (arrows). Panel C: T1-weighted image, showing inhomogeneously hyperintense signal of the pathologic masses (arrows). Panel D: post-contrast image, showing inhomogeneous enhancement of the pathologic mass infiltrating the left ventricular wall. LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle.

post-contrast images highlight pathologic tissue vascularization. Melanoma signal characteristics are dictated by the content in melanin, a natural paramagnetic substance [5] causing T1 shortening, thus generating high signal on T1-images and low-signal on T2-images. This classic finding is present only in a minority of cases. In most cases the signal is inhomogeneously hyperintense both on T1 and T2-images [4]. Usually melanoma metastases show diffuse post-contrast enhancement. Cardiac CT allows disease staging and can identify hemorrhagic pericardial effusion; ^{18}F-fluorodeoxyglucose positron emission tomography (FDG/PET) can distinguish pathologic areas from normal myocardial tissue, and can be combined with CT, to integrate metabolic and anatomic information [6].

Histologic characterization of neoplastic masses is necessary to guide therapy. Pericardial fluid can contain malignant cells; if examination of pericardial fluid is negative, pathologic lesions should be biopsied. Histologic characterization of the tumor led to the prescription of state-of-the-art therapy for BRAF-mutated melanoma, although 1-year prognosis remains severe. A multidisciplinary approach played a key role in the diagnostic workup and management of this complex case.

Conflict of interest

The authors declare that there is no conflict of interest.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jccase.2015.03.001.

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