

# METASTATIC BREAST CARCINOMA TO THE CORONARIES: A RARE CAUSE OF ACUTE MYOCARDIAL INFARCTION

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## Abstract

A 63-year-old female with a history of invasive ductal breast carcinoma presented to the emergency department with symptoms characteristic of myocardial infarction. Electrocardiography showed sinus tachycardia and ST elevations in leads II, III, and aVF, consistent with inferior wall myocardial infarction. A computed tomography (CT) scan of the chest, abdomen, and pelvis with intravenous contrast demonstrated widespread intrathoracic metastatic disease. Cardiac magnetic resonance imaging (MRI) with contrast revealed obstruction of the left ventricular (LV) outflow tract by an LV mass. Cardiac MRI enabled detection of a rare case of myocardial infarction secondary to tumor emboli and intracavitary LV metastasis. This case report emphasizes the role of cross-sectional imaging including CT and cardiac MRI for unusual causes of myocardial infarction, particularly when associated with neoplastic processes.

## Introduction

Acute myocardial infarction (MI) is usually related to coronary artery disease secondary to atherosclerotic plaques that rupture and lead to distal vessel occlusion.<sup>1</sup> Cases of nonatherosclerotic acute MI are less common and can occur from dissection, procoagulant states, drugs, and coronary anomalies. When standard echocardiography is equivocal, cardiac magnetic resonance imaging (MRI) may help to better characterize a cardiac mass and narrow the differential.<sup>2</sup> We report an unusual case of acute MI secondary to coronary tumor emboli from breast carcinoma and elaborate the cardiac MRI findings.

## Case Report

A 63-year-old female presented to the emergency department with hematemesis, weakness, and dizziness. Her past medical history included metastatic invasive ductal breast carcinoma (HER2 positive, estrogen receptor positive, and progesterone receptor positive). At the time of presentation, the patient was status post-mastectomy and had been started on trastuzumab and pertuzumab. The patient had known metastatic disease to the brain and received radiation therapy for these lesions.

An electrocardiogram (ECG) performed in the emergency department demonstrated sinus tachycardia and ST segment elevations in the inferior leads with reciprocal changes laterally. These ECG findings were consistent with an inferior wall MI. Serial troponins every 8 hours were 12 ng/mL, 10.2 ng/mL, 8.55 ng/mL, and 6.98 ng/mL. A complete blood count (CBC) revealed a hemoglobin of 7.8 g/dL and a platelet count of  $39 \times 10^9/L$ , whereas 1 month prior her CBC was within normal limits. Due to the patient's acute hematemesis, anemia, and thrombocytopenia, she was unable to be anticoagulated. The patient was considered to be too unstable for invasive coronary angiography and was admitted to the intensive care unit (ICU).

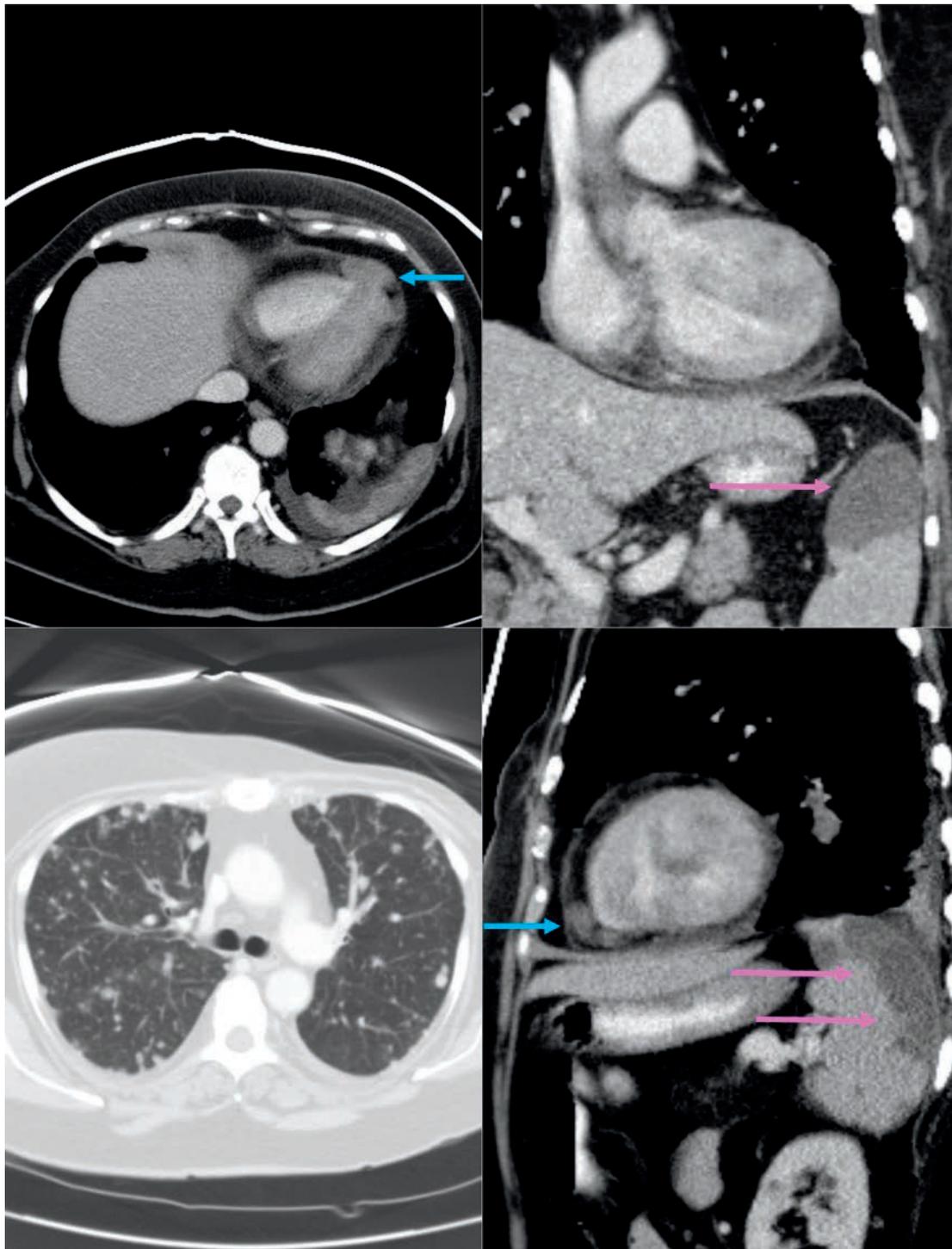
During the ICU admission, the patient was transfused with packed red blood cells and platelets. Her hemoglobin and platelets increased appropriately to 9.3 ng/dL and  $66 \times 10^9/L$ , respectively.

No active gastrointestinal bleeding source was identified. She continued to improve, and the decision was made to pursue further diagnostics as an outpatient.

Consequently, the patient underwent computed tomography of the chest, abdomen, and pelvis with intravenous contrast. The images demonstrated pulmonary and vertebral body metastases. Transthoracic echocardiogram at that time demonstrated a large and highly mobile mass attached to the posterolateral wall of the left ventricle. The differential for these findings included intracardiac tumor, vegetation, or papillary muscle rupture. Cardiac MRI with contrast was then performed. Dynamic cine evaluation of the left ventricle demonstrated dynamic obstruction of the left ventricular (LV) outflow tract by a pedunculated exophytic mass from the lateral wall and papillary muscle (Figures 2 and 3). The inferior septum was hypokinetic and demonstrated delayed contrast enhancement (Figure 4) indicative of infarct. Additionally, splenic metastases resulting in infarcts were identified (Figure 1). This constellation of findings was consistent with MI secondary to tumor emboli. The pedunculated exophytic mass was most likely related to breast metastasis as well. Biopsies were not performed since the patient chose palliative care at this stage.

## Discussion

Although nonatherosclerotic causes of acute MI are not rare, they are still relatively less common. Sporadic reports over the past 25 years describe cases of direct tumor invasion leading to cardiac events.<sup>3</sup> Reports also exist of tumor emboli leading to MI. In one such report, a 13-year-old patient with known metastatic hepatocellular carcinoma presented with resting angina and was found to have ST elevations, a troponin I level of 47 mg/dL, and a tumor in the left inferior pulmonary vein. The tumor was visualized as a mobile mass on echocardiogram and was the proposed embolus resulting in MI. Positron emission tomography demonstrated inferior LV wall myocardial infarct.<sup>4</sup> A second similar report described a 92-year-old male with premortem evidence of MI. Post-mortem evaluation revealed metastatic



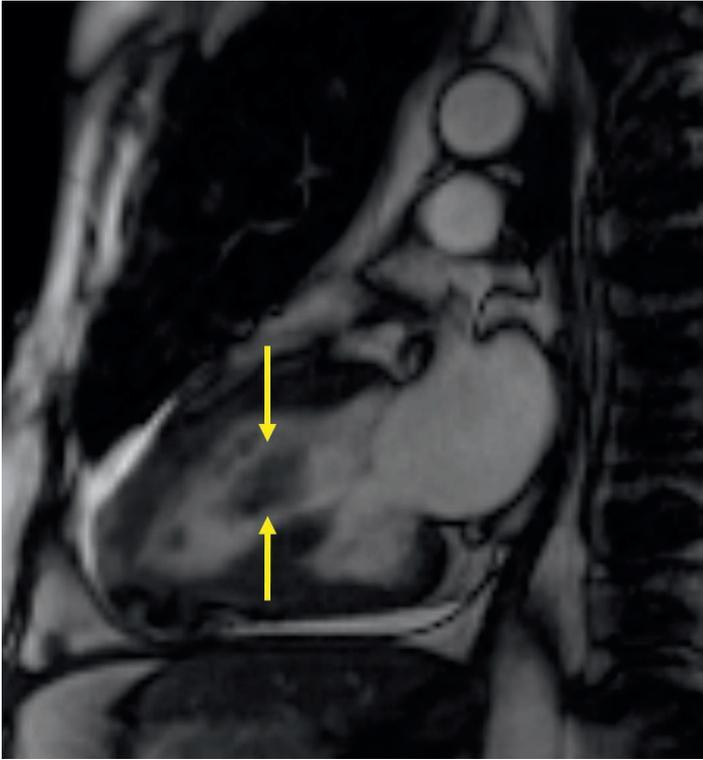
**Figure 1.** Intravenous contrast-enhanced computed tomography images through the chest and abdomen. Top left is axial image representing a pericardial metastasis (blue arrow) at the level of the heart, appearing as an oval-shaped enhancing mass adjacent to the right ventricular apex. Incidentally, there are left pleural metastases with small malignant pleural effusion. Top right coronal image through the left upper abdomen shows a wedge-shaped hypoenhancing upper splenic pole representing infarct from metastasis (pink arrows). Bottom left axial image through the lung bases demonstrates randomly distributed enhancing round lung masses. Bottom right sagittal image through left hemithorax and abdomen shows pericardial metastasis (blue arrow) and splenic infarct (pink arrows).

pancreatic cancer with a metastatic mass in the anteroseptal LV myocardium.<sup>5</sup>

There are also cases of benign lesions leading to MI as well. In one case, a healthy 53-year-old male experienced an anterolateral wall MI due to a 100% occlusion at the proximal part of the obtuse

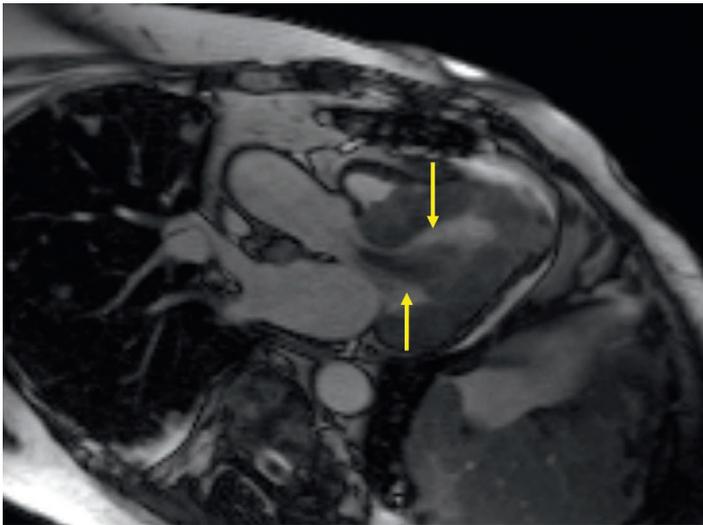
marginal branch of the circumflex coronary artery. Two-dimensional echocardiogram revealed the presence of a left atrial mass, which was subsequently resected and shown to be a myxoma.<sup>6</sup>

Additionally, acute MI cases have also resulted secondary to primary malignant tumors of the heart. In one report, a 53-year-

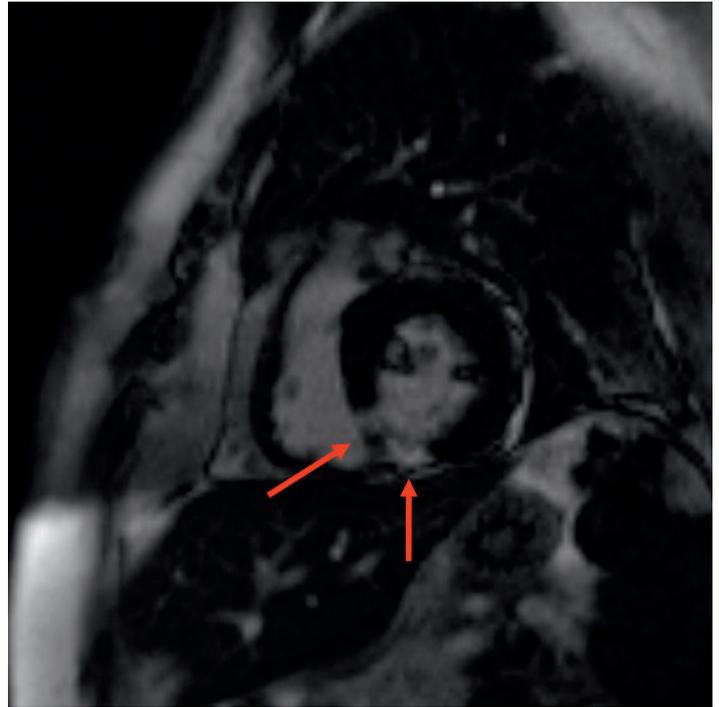


**Figure 2.** Two-chamber view SSFP MR image (TR: 39.6, TE: 1.12, flip angle: 74°, FOV: 276 x 340) demonstrates the lateral left ventricular wall irregular hypointense lesion representing metastasis (yellow arrows). SSFP: steady state free precession; MR: magnetic resonance; TR: repetition time; TE: echo time; FOV: field of view.

old male diagnosed with a STEMI underwent a CT scan, which revealed a mass involving the interventricular septum and apices of the ventricles. The patient was hospitalized and died of heart failure 9 days later. On autopsy, the mass was biopsied and shown to be a primary malignant mesothelioma of the pericardium.<sup>7</sup>



**Figure 3.** Three-chamber LVOT view SSFP MR image (TR: 42.8, TE: 1.19, flip angle: 75°, FOV: 276 x 340) demonstrating the lateral wall lesion resulting in dynamic obstruction of the outflow track. LVOT: left ventricular outflow track; SSFP: steady state free precession, MR: magnetic resonance; TR: repetition time; TE: echo time; FOV: field of view.



**Figure 4.** Short-axis view delayed enhancement MR image (TR: 560, TE: 1.11, flip angle: 45°, FOV: 276 x 340, 30-mL intravenous gadoversetamide) of the left ventricle demonstrates basal inferoseptal full thickness wall enhancement showing a transmural infarct from presumable tumor emboli. MR: magnetic resonance; TR: repetition time; TE: echo time; FOV: field of view.

## Conclusions

Within the literature, this is the first case report describing the MRI findings of proposed metastatic tumor emboli resulting in acute MI. Tumor pathology and coronary angiography are lacking, and the possibility of a plaque rupture or type 2 infarct cannot be excluded. However, the constellation of findings are highly suggestive of metastatic tumor emboli. The patient was healthy and without cardiovascular disease prior to her diagnosis of metastatic breast carcinoma. Cardiac MRI allowed detection and clear visualization of the gross pathology and resulting physiologic insult. Radiologic workup aided in narrowing the differential to metastatic disease resulting in a nonatherosclerotic cause of acute MI, an unusual complication in this instance.

**Conflict of Interest Disclosure:** The authors have completed and submitted the *Methodist DeBakey Cardiovascular Journal* Conflict of Interest Statement and none were reported.

**Keywords:** ST elevation, cardiac MRI, myocardial infarction

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