International Journal of Cardiac Imaging 3: 57–60 (1988)

The role of echocardiography and CT in the diagnosis of cardiac tumors

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Key words: echocardiogram, computerized tomographic scan (CT Scan), cardiac tumors, magnetic resonance imaging (MRI)

Abstract

A young male who presented with atypical chest pain was found to have a primary cardiac tumor. Chest X-ray, electrocardiogram, and echocardiographic findings can be nonspecific. Differential diagnosis and the role of different diagnostic modalities including echocardiogram, computerized tomography and magnetic resonance imaging are discussed.

Introduction

Although cardiac tumors have been recognized since Columbus' report in 1559 [1], the diagnosis of a cardiac tumor has generally been made either at post mortem or at surgery. However, echocardiography has proven to be a reliable non-invasive technique for imaging cardiac tumors, making antemortem diagnosis of cardiac tumors more feasible [2].

More recently, great advances have occurred in non-invasive cardiac imaging with the addition of high speed CT scanners and magnetic resonance imaging, facilitating diagnosis of cardiac tumors. The purpose of this report is to highlight the use of non-invasive measures, namely echocardiography and CT to reveal the cause of an unusual presentation in a patient with primary sarcoma of the heart.

Case

A 28-year-old white male, stating a questionable history of hypertension and a significant history of ethanol abuse, was admitted for evaluation of cardiomegaly and atypical chest pain. The patient had apparently been well until about two weeks prior to admission to University of Michigan Hospital when he developed sharp upper back and substernal pain that would often wake him from sleep.

Physical exam revealed an acyanotic white male in no apparent distress, afebrile. His blood pressure was 110/70, pulse 72 and regular, temperature 98° F, R 16. Lungs revealed a few scattered wheezes, but were otherwise clear to auscultation and percussion. The jugular venous pressure was measured at 12 cm above the sternal angle. Right ventricular lift, loud pulmonic component of S2, and a grade II/VI medium pitched systolic murmur, best heard at the third left intercostal space at the sternal edge, decreasing with inspiration and increasing with expiration, were noted. No S3 or diastolic murmur was noted.

Pertinent laboratory findings included mild leukocytosis, mildly elevated Westergren ESR, and normal room air arterial blood gas. The chest radiograph revealed 4 chamber cardiac enlargement with redistribution of pulmonary vasculature consistent with pulmonary congestion (Fig. 1). The eletrocardiogram showed non-specific ST-T wave changes.

An initial echocardiogram showed normal left

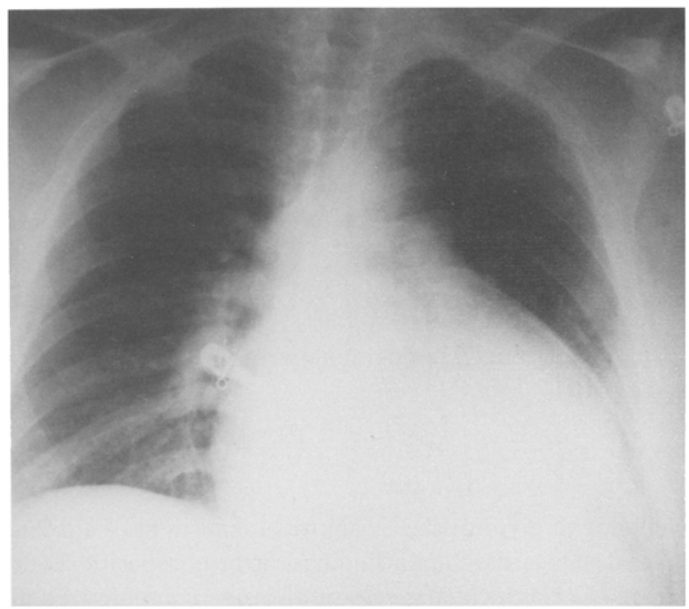

Fig. 1. P-A view showing gross enlargement of pericardial silhouette with redistribution of pulmonic vascularity.

ventricular size and function. There was a clear space behind the left ventricle containing an echogenic mass apparently attached to the posterior wall of the left ventricle, bulging into the pleural space (Fig. 2). A cardiac tumor was suspected. A second echocardiogram performed 3 days later following an unexplained bout of hypotension was unchanged. The parasternal short axis and apical four-chamber views were not satisfactory and thus not helpful in further elucidating the nature, origin, and extent of the mass.

A chest CT scan showed a large irregular low attenuation mass to the left of and inferior to the left atrium, probably cardiac in origin (Figs. 3A

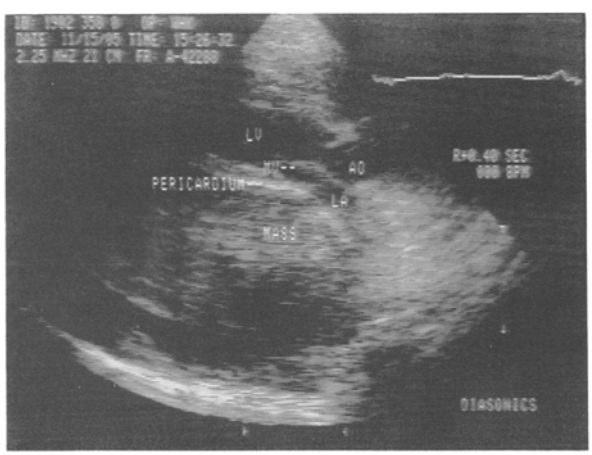

Fig. 2A. Parasternal long axis view showing a large clear space behind the left ventricle containing an echo dense mass possibly attached to the pericardium and bulging into pleural space consistent with a tumor.

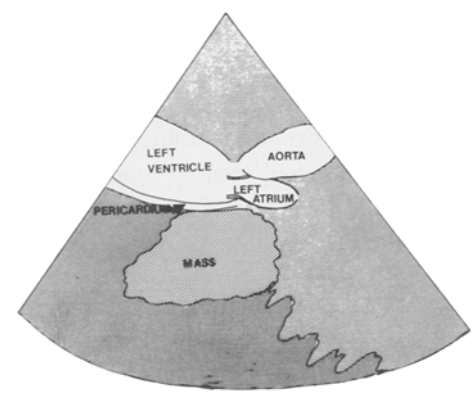

Fig. 2B. Artistic rendition of the echocardiogram obtained in the parasternal long axis view showing the relation of the mass to the pericardium.

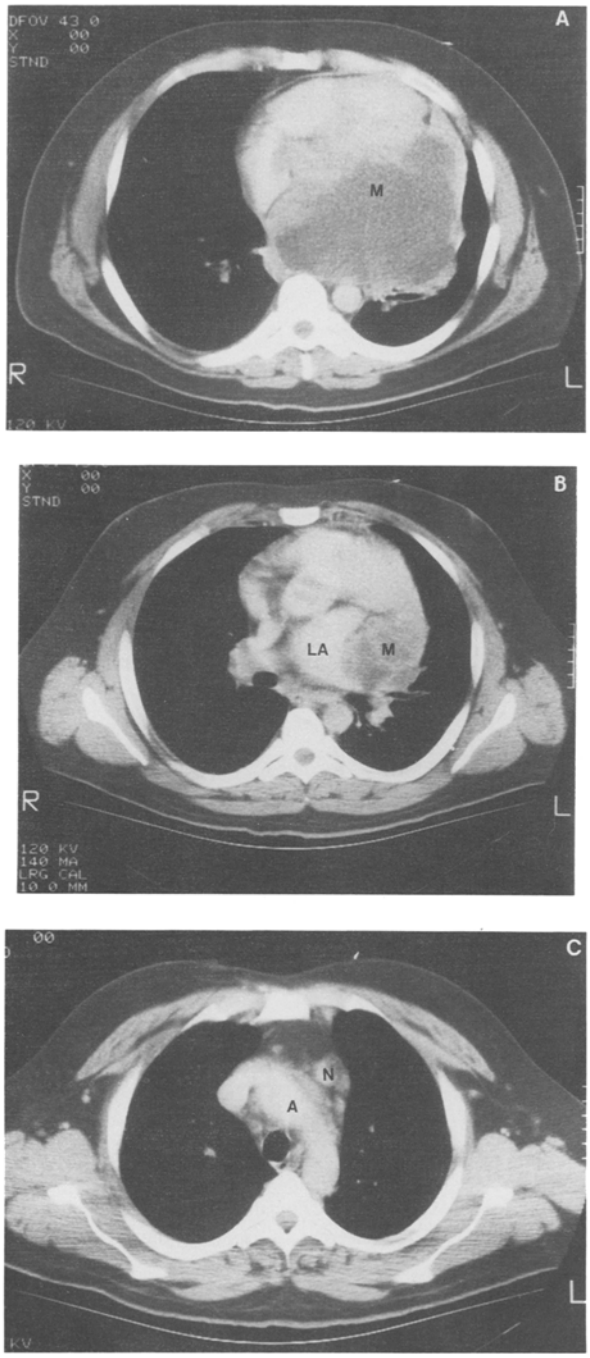

Fig. 3. CAT images. *A.* At the caudal aspect of the heart, there is a large low attenuation mass (M) infiltrating into the adjacent cardiac chambers. *B.* At the level of he left atrium (LA), the mass (M) is nearly surrounded by the atrium, suggesting an intracardiac origin. *C.* At the level of the aortic arch (A), there are abnormally enlarged lymph nodes (N) in the anterior mediastinal fat.

and 3B). In addition, abnormally enlarged mediastinal lymph nodes were noted (Fig. 3C).

The patient was taken to the operating room where thoracotomy and myocardial biopsy were performed revealing undifferentiated sarcoma originating from the heart.

Discussion

This patient represented a diagnostic dilemma, presenting with chest pain, cardiomegaly presumed to be of recent onset and rapid clinical deterioration. Initial concerns included aortic dissection and alcoholic cardiomyopathy; other less likely possibilities included ruptured Sinus of Valsalva or chorda tendineae, hypertensive cardiomyopathy, and myocarditis.

The initial echocardiogram, although abnormal, was most suggestive of loculated posterior pericardial effusion or tumor. Chest CT confirmed the presence of a cardiac tumor, defining its location and extent. Thoracotomy with biopsy established the diagnosis of a primary undifferentiated cardiac sarcoma.

Why tumors are suitable for echo/CT

Echocardiography has evolved as the preferred noninvasive procedure for cardiac evaluation. Advantages include: 1) safety, 2) practicality, 3) convenience and ease, 4) relatively low cost, 5) ability to image the heart in motion and in multiple tomographic planes. It also is the initial study for evaluation of cardiomegaly as it provides excellent visualization of the cardiac chambers and great vessels.

Additionally, echocardiography has been stated to be the noninvasive method of choice for detection of suspected intracardiac tumors [3]. Echocardiography is particularly useful in the characterization of intracardiac masses as cystic or solid. It can be used repeatedly during the natural course of any cardiovascular disease. Its drawbacks include: 1) high dependence on the technician's experience, 2) degradation of image resolution secondary to an

inadequate acoustic window, 3) false diagnosis of intracardiac masses produced by artifacts or normal structures.

Computed tomography (CT) was introduced in the early 1970s as a new diagnostic technique. However, the relatively long scanning times of first generation CT scanners, resulted in limited utility for cardiac imaging secondary to motion artifact. More recently, ultrafast CT scanners have been introduced that are capable of 30–50 msec scan times with excellent density resolution, allowing for improved imaging [4]. However, even standard third- and fourth-generation CT scanners are capable of acquiring excellent cardiac images in under 5 seconds. The images from Fig. 2 were obtained with such a scanner. It is now felt that CT may be the imaging modality of choice for displaying pericardial masses directly [5] and may be superior to echocardiography and angiography in the detection of ventricular thrombi [6]. In patients with cardiac tumors, CT evaluates the extent of disease (i.e., invasion of contiguous structures) and defines the relationship of cardiac involvement to other thoracic structures better than echocardiography. Dynamic scanning after bolus intravenous injection of contrast material is recomended for evaluation of patients with suspected masses involving the heart and pericardium [6]. The major disadvantages of CT include: 1) requirement of exposure to intravenous contrast medium, 75–150 ml, 2) exposure to radiation (with ultrafast scanners approximately 300 millirads skin dose per image with average study exposing patient's chest to approximately 7.5–10 rads) [7], 3) limited experience with CT scans evaluating the cardiovascular system, 4) high cost, 5) relative scarcity of ultrafast CT scanners.

MRI

Magnetic resonance imaging, a completely noninvasive technique without radiation hazard which can provide tomographic images of the whole heart, offers great potential for cardiovascular diagnosis. Currently, characteristic proton relaxation times for normal and pathological tissues are being determined. It is expected that ischemic and normal myocardial tissue can be distinguished as well as neoplastic vs. non-neoplastic tissue.

Although primary cardiac tumors are relatively scarce, their detection can be aided by echocardiography and CT. If tumor is felt to be intracardiac in origin, echocardiography might suffice. However, if tumor is pericardial in origin or the extent of its involvement into adjacent structures needs to be determined, bolus dynamic CT or MRI is warranted.

Summary

A case of a 28-year-old, previously healthy male who developed progressive cardiac symptoms within a 2 week period associated with cardiomegaly and a dearth of objective clinical findings is reported. The cause was determined to be a primary cardiac sarcoma. The importance of the echocardiogram and CT scan in leading to the ultimate diagnosis of tumor is emphasized.

Acknowledgments

We would like to thank Mrs. Mildred Herman for her work in preparing this manuscript.

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