Cardiac Metastasis From Uterine Leiomyosarcoma

JOSEPHINE L. MARTIN, MD, JOSEPH G. BOAK, MD, FACC

Neptune, New Jersey

The clinical course and echocardiographic and hemodynamic derangements in a case of uterine leiomyosarcoma metastatic to the heart are discussed. The literature on cardiac metastasis in general and cardiac involvement by leiomyosarcoma in particular is reviewed. Although the presentation of cardiac tumors is highly variable and the diagnosis is usually made postmortem, antemortem diagnosis is possible, as in this case, if a high index of suspicion is combined with information from two-dimensional echocardiography and cardiac catheterization.

Leiomyosarcoma metastatic to the heart is extremely rare. Its echocardiographic and hemodynamic effects and clinical presentation have not been described previously. We report on such a case and review the literature on the behavior of metastatic cardiac tumors in general and leiomyosarcoma in particular.

Case Report

A 30 year old white female schoolteacher with rheumatic mitral stenosis and regurgitation delivered a healthy baby boy on February 26, 1979 after an uneventful first pregnancy. Thereafter, she became progressively dyspneic with increasing episodes of supraventricular tachycardia. In December 1979, cardiac catheterization revealed severe mitral valve disease; a Bjork-Shiley mitral valve prosthesis was implanted on January 19, 1980 without complications. No other cardiac abnormalities were noted.

On August 30, 1980, the patient was admitted to the hospital for lower abdominal pain. Laparotomy revealed a large leiomyosarcoma of the uterus with necrosis and perforation of the tumor and free blood in the peritoneum. The tumor had a high mitotic index. The ovaries and fallopian tubes were normal. Biopsy of omentum, exploration of posterior aortic and lumbar nodes and inspection and palpation of liver, spleen and kidneys revealed no tumor. A total hysterectomy was performed; the patient received pelvic irradiation and was able to return to work by January 1981.

Cardiac findings. Cardiac evaluation as late as February 1981 revealed no dyspnea, chest pain or murmur. However, in March 1981, a systolic murmur was heard along the lower left sternal border. Over the next 4 months the patient had increasing fatigue, dyspnea and orthopnea with only temporary improvement with digoxin and diuretic drugs. By July 1981, the murmur had increased to grade 3/6 and she was in New York Heart Association functional class III. Chest X-ray films were normal except for generalized cardiomegaly, not present 1 year earlier. Electrocardiography revealed biventricular hypertrophy and atrial fibrillation, not present at initial evaluation 18 months earlier. Two-dimensional echocardiography showed a pedunculated mobile mass in the left ventricle and marked thickening of the interventricular septum with narrowing of the right ventricular outflow tract (Fig. 1).

Cardiac catheterization revealed no significant paravalvular mitral regurgitation and a normally functioning mitral valve prosthesis. Pressures in the aorta, left ventricle, pulmonary wedge and pulmonary artery were normal. On right heart pullback, a subpulmonary valve stenosis in the outflow tract of the right ventricle with a 60 mm gradient was found (Fig. 2d). Right ventriculography revealed severe tricuspid regurgitation and systolic obstruction of the outflow tract of the right ventricle (Fig. 2a and b). Left ventriculography revealed a hemispherical mass protruding into the cavity of the left ventricle below the mitral valve at the base of the septum (Fig. 2c). Coronary arteriography did not show any neovascularization or abnormality of myocardial perfusion. Metastatic study, including liver and lung scan, computed axial tomography of abdomen and pelvis, sonography of abdomen and cytologic examination of abdominal ascitic fluid, was negative.

Surgical findings. Aggressive medical therapy was unsuccessful in preventing clinical deterioration to class IV.
The patient underwent cardiac surgery on September 4, 1981 in an attempt to provide some hemodynamic relief from the right ventricular outflow obstruction. The right ventricle was opened and a 10 × 2.5 cm dense, grayish tumor was found bulging from the interventricular septum, obstructing the right ventricular outflow tract and involving the chordae of the tricuspid valve with resulting tricuspid regurgitation. The tumor was pathologically identical to the leiomyosarcoma of the uterus removed 1 year earlier. Although the right ventricular gradient was completely relieved, the patient developed refractory low cardiac output and died 48 hours after surgery, 1 year after the initial discovery of her malignancy.

**Discussion**

**Incidence of cardiac metastasis.** Most recent reports have focused on primary cardiac tumors, especially myxomas. Since the classic description by Adams et al. (1), extensive study of such tumors has produced widespread understanding of their clinical behavior, pathology, prognosis and diagnosis. With the development of echocardiography, the diagnosis of intracardiac myxoma or thrombus is now routinely made by the clinician, despite their protean presentations.

Much less attention has been paid to the behavior and presentation of disease metastatic to the heart. Nevertheless, the heart is affected 16 to 40 times more frequently by metastasis than by primary tumors (2). The reported incidence of cardiac metastasis found at autopsy of cancer patients ranges from 5 to 20% (3–5). Malignant melanoma, leukemia and malignant lymphoma are the most common sources of metastasis to the heart. Such metastasis is usually associated with widespread tumor dissemination and rarely limited to the heart and pericardium (2,6,7).

**Cardiac involvement in uterine leiomyosarcoma.** Uterine leiomyosarcoma is rare, with an incidence of 0.6 per 100,000 women over age 20 years and a mean age of 50 years at time of diagnosis (8). It usually metastasizes to the liver and lung. Our case is atypical in several ways: 1) the patient was considerably younger than usual; 2) the heart is an unusual site of metastasis; and 3) no metastasis was detectable outside the heart despite an extensive search.

Cardiac involvement by uterine leiomyosarcoma is extremely rare. The Armed Forces Institute of Pathology reports six instances, but with no clinical details (9). Extensive search reveals only one reported case (10), but the diagnosis was not made until autopsy because the patient presented with a syndrome mimicking acute rheumatic fever or endocarditis. This is the first reported case in which the diagnosis was made antemortem.

**Mode of metastatic spread.** Tumors spread to the heart by hematogenous and lymphatic routes and by direct extension. Cancer of the lung, mediastinum and chest wall may involve the heart or pericardium, or both, by direct extension. The lower incidence of hematogenous and lymphatic metastasis to the heart as compared with other organs has been attributed by various authors to the strong kneading action of the heart, metabolic peculiarities of the heart muscle, rapid intracardiac blood flow and restricted cardiac lymphatic connections (11,12).

In our case, the most probable mode of tumor spread to the heart was hematogenous. The previous rheumatic involvement of the heart may have made it more susceptible to metastasis. Alternatively, cardiac surgery may somehow have altered the endocardium to make it more receptive to hematogenous metastasis.

**Clinical features of cardiac metastasis.** Cardiac metastasis will generally produce clinical findings only when the heart is involved extensively. Findings are variable and may include progressive heart failure, intracavitary obstruction, changing heart murmurs, arrhythmia, embolism, bizarre cardiac silhouette and syndromes mimicking pericarditis, idiopathic hypertrophic subaortic stenosis, endocarditis or acute rheumatic fever (2,5,13–15). Atrial fibrillation and flutter are the most common arrhythmias (14). Bundle branch block or complete heart block may occur if the tumor invades the interventricular septum (2,16).

The most common echocardiographic evidence of metastasis is pericardial effusion. A thickened interventricular septum or tumor mass protruding into a cardiac chamber
Figure 2. Thirty degree right anterior oblique cineventriculograms of the right ventricle (RV) in diastole (a) and systole (b) show complete interruption of flow from the right ventricle to the pulmonary artery (PA) in midsystole (arrowheads) due to outflow obstruction of the right ventricle by the intraventricular tumor. The hemodynamic effect of this is the subpulmonary valve stenosis demonstrated (d) on pullback of the catheter from the pulmonary artery (PA) to the right ventricular outflow tract (RVO), past the tumor to the right ventricular inflow tract (RVI), to the right atrium (RA). Systolic pressure in the right ventricular outflow tract is 60 mm Hg lower than in the inflow tract because of obstruction by the tumor in systole. Although in (a) and (b), the injection was made into the right ventricle, the right atrium is clearly seen because of severe tricuspid regurgitation. At surgery, it was discovered that the regurgitation was due to shortening of the tricuspid chordae caused by tumor involvement, hence, holding the tricuspid valve open in systole. The left ventriculogram (c) shows the pedunculated tumor producing a hemispheric projection (arrowheads) from the base of the septum into the left ventricle. The mitral valve prosthesis (MP) is working normally; there is no paravalvular leak or mitral regurgitation into the left atrium. The pigtail catheter is positioned at the apex of the left ventricle for this 30° right anterior oblique ventriculogram.

may also be seen (15,17). Two-dimensional echocardiography is superior to M-mode recording in demonstrating the size, location and mobility of tumors (18). However, thrombus (19) and vegetations (2) may mimic intracardiac tumors echocardiographically; hence, even with two-dimensional evaluation, the echocardiographic pattern may be nonspecific.

Diagnosis. This patient presented with increasing cardiac size, atrial fibrillation, biventricular hypertrophy, a changing murmur and progressive intractable congestive failure. She progressed from an asymptomatic state to functional class IV and cardiac death in just 6 months. Initially, her symptoms were thought to be due to a malfunctioning prosthetic mitral valve or paravalvular leak, however, evaluation rapidly excluded these possibilities. The history of recent surgery for leiomyosarcoma, the clinical presentation and the echocardiographic and catheterization data permitted an accurate antemortem diagnosis.

As this case demonstrates, currently available diagnostic cardiac tests have great power when used in combination, even in highly atypical cases. This has practical impact on the patient’s management. As cancer chemotherapy and surgical techniques improve, accurate antemortem diagnosis of cardiac metastasis will be an essential prerequisite to more precise therapy, and thus, better management of these patients.

References