

# Right Ventricular Thrombus Mimicking a Myxoma in a 19-Year-Old Man

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**D**iscovery of a cardiac mass in a symptomatic patient who had been previously healthy often poses a major diagnostic dilemma. Although the differential diagnoses seem endless, myxomas and thrombi are the 2 major diagnoses that concern most physicians. We report the case of a man with a right ventricular mass mimicking a myxoma. Pathologic testing revealed that the mass was a focal-organizing thrombus, and the patient was subsequently diagnosed with antiphospholipid syndrome (APS) after laboratory testing revealed increased levels of antiphospholipid antibodies. This article discusses clinical features of APS, the differential diagnosis of a right ventricular mass, and diagnosis and management of thrombi.

## CASE PRESENTATION

### Initial Presentation and History

A 19-year-old African American man with no significant past medical history presented to his primary care physician with a chief complaint of having had shortness of breath over the previous 2 months. He had been seen in the emergency departments of 3 different hospitals during the previous month and was treated for bronchitis during each visit. The patient was referred to a cardiologist, and a 2-dimensional (2-D) echocardiogram revealed several echodense masses in the right ventricle associated with severe tricuspid regurgitation (**Figure 1**). One of the masses measured approximately 3 cm across its largest diameter. The patient's pulmonary artery pressure was between 60 and 90 mm Hg, and he had a dilated right ventricle and enlarged right atrium. The patient was admitted to a local hospital where a ventilation-perfusion scan showed high probability for pulmonary embolus; heparin therapy was started immediately. The patient remained stable overnight and awoke the next morning with worsening shortness of breath. The patient was intubated due to his sharply diminishing oxygen saturation and was transferred to our hospital for further evaluation.

### Imaging Studies

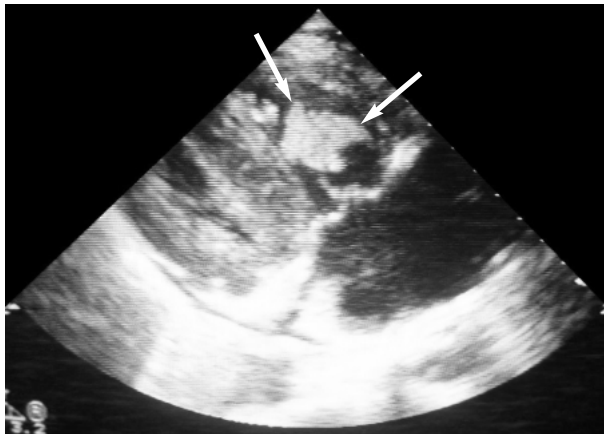
An initial anteroposterior plain chest radiograph revealed decreased vascular markings in the right lung and left lower lobe. A spiral computed tomography (CT) scan of the chest with nonionic contrast showed a thrombus at the bifurcation of the upper and lower branches of the right pulmonary artery, with extensions into the right lower lobe branch (**Figure 2**). Another thrombus was noted in the left upper and lower lobe of the pulmonary artery, creating an almost complete occlusion. The heart appeared unremarkable, and there was no evidence of hilar or mediastinal lymphadenopathy or mass lesions. Hepatomegaly was noted, and the esophagus was unremarkable.

### Continued Clinical Course

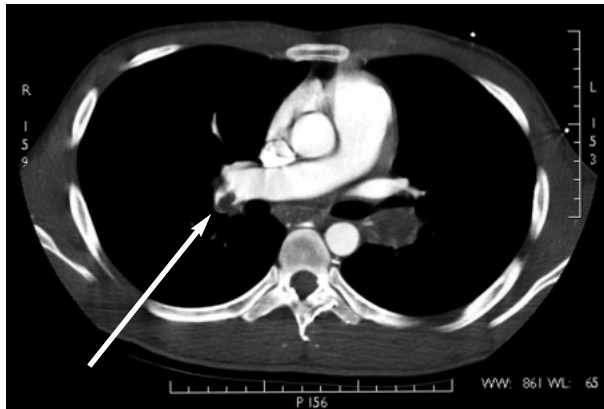
The patient remained intubated with an oxygen saturation of 90% on 100% fractional concentration of oxygen in inspired gas ( $\text{FiO}_2$ ) and a blood pressure of 110/70 mm Hg, heart rate of 128 bpm, and low urine output. A transesophageal echocardiogram (TEE) confirmed the 2-D echocardiogram findings of a right ventricular mass thought to be associated with the tricuspid valve. The consulting cardiothoracic surgeon considered the patient too unstable for surgery, and therefore thrombolytic therapy with alteplase was started at 100 mg infused over 2 hours. The patient started to improve, and the  $\text{FiO}_2$  was lowered to 50% while maintaining 100% saturation. A repeat portable chest radiograph showed marked reperfusion of both lung fields. Urine output started to increase, and the patient's vital signs improved (blood pressure, 120/70 mm Hg; heart

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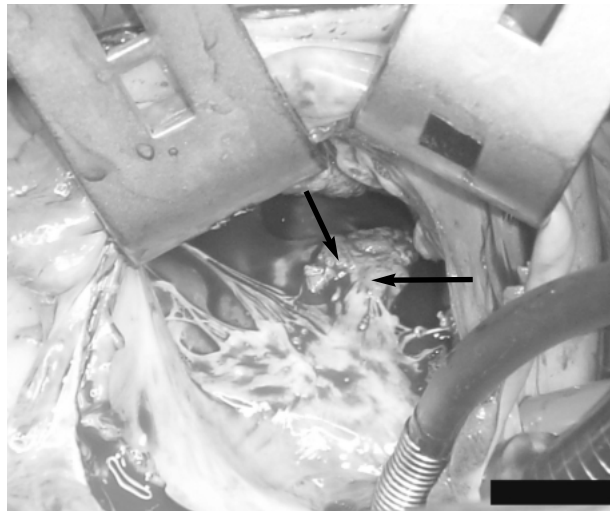
**Figure 1.** A 2-dimensional echocardiogram showing several echodense masses (arrows) in the right ventricle of the case patient.



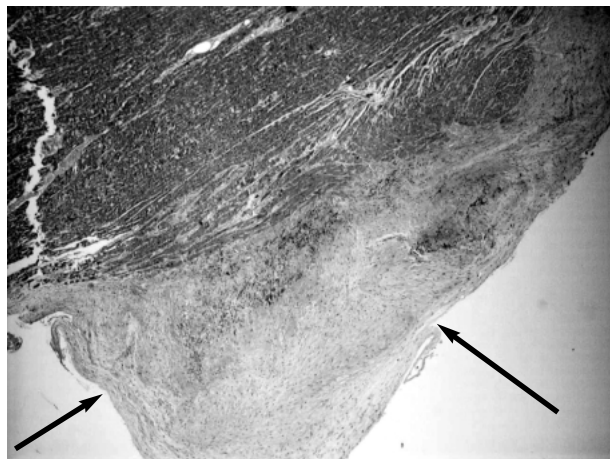
**Figure 2.** A spiral computed tomography scan demonstrating a thrombus in the case patient (arrow).

rate, 100 bpm). Because a repeat 2-D echocardiogram showed a persistent right ventricular mass, the cardiothoracic surgeon decided that the patient required surgery.

During surgery, the patient was placed on cardiopulmonary bypass. His pulmonary artery pressures were 90/48 mm Hg measured by direct pulmonary artery catheterization (systemic blood pressure was 110/50 mm Hg). Milrinone lactate and prostacyclin were used to control pulmonary hypertension. The patient's right atrium was opened, the tricuspid valve was exposed, and the right ventricle was examined. Multiple intracardiac masses were seen on the papillary muscles and chordal system; there was also a larger mass invading the interventricular septum (**Figure 3**). The tricuspid valve and most of the subvalvular apparatus were removed, and a prosthetic tricuspid valve was placed. The patient tolerated the surgery and was extubated 3 days later.



**Figure 3.** Multiple intracardiac masses (arrows) seen on the papillary muscles and chordal system during surgical intervention.



**Figure 4.** Pathologic analysis of the case patient's right ventricular mass showing fragments of a recent, focal-organizing thrombus (arrows).

Pathologic analysis of the right ventricular mass showed fragments of a recent, focal-organizing thrombus (**Figure 4**); the papillary muscle and valve showed similar findings. The papillary muscle also contained acute ischemic changes with myocyte necrosis and neutrophilic infiltrate consistent with a recent acute infarct. There was no evidence to support a diagnosis of a neoplasm, such as myxoma or papillary fibroblastoma. The possibility of endocarditis was ruled out with negative cultures and negative Gram and Grocott-Gomori methenamine–silver nitrate stains for microorganism.

The results of initial laboratory testing for a hypercoagulable state, including tests for protein C and protein S

deficiency, antithrombin III deficiency, factor V Leiden, and hyperhomocystinemia, were negative. A repeat work-up revealed an increased level of antiphospholipid antibodies (IgG), suggesting a diagnosis of APS. Appropriate long-term anticoagulation treatment was started, and the remainder of the patient's stay was unremarkable except for an episode of pseudomembranous colitis that was successfully treated.

## **DISCUSSION**

### **Antiphospholipid Syndrome**

APS is a hypercoagulable state in which antibodies directed towards negatively charged phospholipids and various protein cofactors promote the formation of thrombi. Clinically, APS is characterized by recurrent thrombosis and pregnancy complications (eg, miscarriage). Secondary APS can be found in association with autoimmune disorders such as systemic lupus erythematosus (SLE), other rheumatologic disorders, malignancies, and certain drugs (eg, cyclosporine, tacrolimus, mitomycin C); primary APS occurs without these concomitant disease processes. The main clinical features of primary APS include thrombosis (32%), thrombocytopenia (22%), livedo reticularis (20%), stroke (13%), and pulmonary embolism (9%). Less common manifestations include transient ischemic attack, hemolytic anemia, migraine headaches, Raynaud's phenomenon, pulmonary hypertension, avascular necrosis, continuous ulcers, adrenal insufficiency, nephritic syndrome, and valvular heart disease.

Thrombosis is the most common and harmful manifestation of APS. Venous thrombosis is more common than arterial thrombosis, with the lower leg being the most common site of occurrence. The inferior vena cava, renal, hepatic, axillary, subclavian, or retinal veins may also be involved. Intracardiac mural thrombi have been reported as a manifestation of primary APS and secondary APS associated with SLE. In one report, 3 patients with right atrial thrombi associated with APS developed pulmonary emboli; none of them had right ventricular thrombi.<sup>1</sup> Other cases of intracardiac thrombosis have been reported.<sup>2-7</sup> Nonbacterial endocarditis and aortic and mitral valve vegetations are the predominant heart manifestations of APS. Independent of a hypercoagulable state, these lesions can cause spontaneous thrombosis and embolization.<sup>2</sup> In a study of 11 patients with APS, SLE, and valvular heart disease, 8 patients had aortic regurgitation, 2 patients had associated mitral regurgitation, and 3 patients had isolated mitral regurgitation.<sup>8</sup> Additional cardiac abnormalities accompanying APS include myocardial infarction, pericardial

effusion, coronary artery bypass graft failure,<sup>9</sup> and embolic strokes caused by thrombotic vegetations.<sup>10</sup>

Serologically, APS is characterized by the presence of anticardiolipin antibodies and anti- $\beta_2$ -glycoprotein I antibody. APS is also associated with lupus anticoagulant antibody activity; the presence of these antibodies is detected by an unexplained prolongation of activated partial thromboplastin time that does not normalize with the dilution of the patient's plasma with platelet-free plasma. APS is also associated with a false-positive Venereal Disease Research Laboratory test result for syphilis.<sup>11</sup> The presence of at least 1 clinical criterion (eg, vascular thrombosis, pregnancy morbidity) plus 1 laboratory criterion (eg, anticardiolipin antibodies, lupus anticoagulant) is considered diagnostic for APS.<sup>12</sup>

### **Differential Diagnosis of a Right Heart Mass**

The finding of an intracardiac echogenicity in a previously healthy man poses a diagnostic challenge. The 2 main differential diagnoses are atrial myxoma and mural thrombus. Other possibilities include metastatic tumor, other primary benign or malignant tumors, vegetations, and nonpathologic variants.<sup>13</sup> Mural thrombi in normal hearts are extremely rare but have been reported in patients with malignancies,<sup>14</sup> ulcerative colitis,<sup>15</sup> interleukin-2 infusion,<sup>16</sup> Behçet's disease,<sup>17</sup> and hypercoagulable states, including APS.<sup>17</sup>

The case patient's history did not suggest a cardiac structural abnormality prior to his presentation, nor did he have evidence of malignancy. However, right ventricular myxomas are also very rare, comprising 3% to 4% of all myxomas.<sup>13</sup> Clinically, both myxomas and mural thrombi can present with a pulmonary embolism. In the case of myxomas, these pulmonary emboli can either be a thromboembolism (more common) or tumor embolism (less common). The distinction is important when considering treatment options, such as thrombolytic therapy, because tumor emboli are less likely to respond to such treatment.

There also was nothing in the patient's history or physical examination to suggest an infective process, and large vegetations would typically present in the context of infective endocarditis. Normal nonpathologic variants that could be included in the differential diagnosis of an intracardiac mass include Chiari's network (a fine membrane with fine perforations attached to the coronary sinus), eustachian valves (the remnant of a valve that runs between the inferior vena cava and coronary sinus in embryonic life), false tendons, moderator bands (muscular structure traversing from the septum to the apex of the right ventricle), annular

calcification, atrial septal aneurysms, and Lambli's excrescences (compaction of mesothelial stripes and fibrin). All of these structures can be identified based on location and echocardiographic characteristics.<sup>18</sup>

### Diagnosis of Thrombi

Most authorities agree that TEE is superior to transthoracic echocardiogram in differentiating tumors from thrombi.<sup>13</sup> TEE provides structural details, such as invasion of underlying cardiac structures and points of attachment.<sup>18</sup> The presence of a massive pulmonary embolism usually suggests a thrombus, although atrial myxomas can also embolize and it may be difficult to distinguish thromboembolism from tumor embolism. Certain patterns on ventilation/perfusion and CT scans may suggest tumor embolism.<sup>19</sup> For example, a segmental contour pattern (ie, numerous perfusion defects outlining pulmonary fissure and bronchopulmonary segments) on a ventilation-perfusion scan favors a diagnosis of tumor embolism rather than thromboembolism.<sup>19</sup> Other perfusion patterns seen with tumor emboli include focal subsegmental defects, focal segmental defects, or complete lung defects (seen in the case patient). Similar defects, however, can be seen in thromboembolism. Right heart catheterization and pulmonary wedge aspiration cytology can also be used to distinguish between tumor embolism and thromboembolism.<sup>19</sup>

### Management of Thrombi

Treatment options for a right heart thrombus with pulmonary embolism include surgical exploration of the right heart chambers and pulmonary arteries, thrombolytic therapy, and percutaneous mechanical thrombectomy. In a study of 38 patients with right heart thrombi, there was no difference in mortality between patients treated with surgery and those treated with thrombolytic therapy.<sup>20</sup> Three thrombolytic drugs (ie, urokinase, streptokinase, and recombinant tissue plasminogen activator) have been approved by the US Food and Drug Administration for treatment of severe pulmonary embolism; alteplase is usually the preferred agent because its shorter half-life makes surgical intervention possible in cases where thrombolytic therapy fails. In general, thrombolytic therapy has the advantage of lysing thrombi in the pulmonary arteries that are not always accessible by surgical exploration.

In the case patient, thrombolytic therapy lysed the thrombus in the pulmonary artery, resulting in reperfusion of the lung and improvements in oxygenation and cardiac output. Although thrombolytic therapy failed to lyse the thrombus in the patient's right ventricle, it

improved his overall condition and made it possible to proceed to surgery.

### CONCLUSION

The presence of a right ventricular mass in any patient can be associated with a variety of etiologies. Although myxomas and thrombi are at the top of the differential diagnosis, it is important to rule out other possibilities, such as metastases, vegetations, and non-pathologic variants. Many noninvasive imaging options for diagnosis exist, but the gold-standard and often necessary diagnostic technique is pathologic analysis. In the case patient, a seemingly textbook diagnosis of myxoma was rejected by pathology to reveal a thrombus (the result of APS). The thorough investigation of this patient's cardiac mass not only led to the diagnosis of APS, but prompted treatment before an antiphospholipid crisis caused significant morbidity or mortality. **HP**

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