Invasive Aspergillosis
Extensive Cardiac Involvement Demonstrated by Cardiac Magnetic Resonance

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A 60-year-old woman with a diagnosis of leukemia, who had undergone allogeneic stem cell transplantation, was transferred from her local hospital for further investigation of a cardiac mass. A recent graft-versus-host reaction had culminated in a fungal infection of the lungs, subsequently confirmed on biopsy. This was monitored with serial computed tomography (CT) scans of the chest, one of which showed an incidental finding of a large mass within the left ventricular outflow tract (Figure 1). On arrival at our institution she was asymptomatic, and a number of investigations to identify the nature of the mass were undertaken. The electrocardiogram showed Q-waves in the anterolateral leads and inverted T-waves in all precordial leads (Figure 2). The chest radiograph (Figure 3A) demonstrated an ill-defined opacity projected over the medial right hemidiaphragm corresponding with a nodular abnormality noted on the last chest computed tomography (Figure 3B). Transthoracic echocardiography and transesophageal echocardiography confirmed the presence of a large mass visible in the left ventricular outflow tract adherent to the interventricular septum just below the aortic valve, filling a considerable portion of the outflow tract (Figure 4 and Movies I and II in the online-only Data Supplement). Left ventricular function was normal. Computed tomography and magnetic resonance imaging of the brain revealed small embolic foci with hemorrhagic changes but no signs of fungal abscesses. The patient underwent cardiac surgery for removal of the intracardiac mass. At surgery, the mass arising from the septum was excised, and further lesions extending out from the main muscle body were noted. Subsequent histological analysis of the mass confirmed invasive aspergillosis.

The postoperative period was characterized by persisting breathlessness and clinical and radiological signs of bilateral pleural effusion. Ongoing concerns regarding the extent of cardiac involvement resulted in a referral for a cardiac magnetic resonance (CMR) scan 4 weeks after surgery. The CMR scan revealed 3 distinct types of cardiac lesions. First, in the left ventricular outflow tract, a 3×6-mm large mobile round mass adherent to the basal septum was visualized in the cine steady-state free precession images, most likely representing residual aspergilloma (Figure 5A and Movie III in the online-only Data Supplement). Second, a localized area of transmural enhancement in the lateral wall of the left ventricle was seen on the late gadolinium images, consistent with transmural myocardial scar (Figure 5B). Third, 3 focal lesions on late gadolinium imaging with circular hyperenhancement and a central hypoenhanced core were noted in the basal anterior, basal inferolateral, and apical inferior walls, most likely corresponding with the areas of fungal infection described at the time of surgery (Figure 5C and Figure 5D). These lesions were located in corresponding areas of relatively reduced myocardial signal intensity in the cine steady-state free precession images (Figure 5A).
She was treated aggressively with voriconazole and caspofungin therapy; however, her disseminated infection proved overwhelming and she died a few weeks later. An autopsy was not performed.

Invasive aspergillosis with multiple cardiac manifestations is rare but usually fatal, and the diagnosis is challenging. A combination of clinical and imaging findings, isolation of Aspergillus, serological evidence, and histopathologic demonstration of invasion are necessary. This case demonstrates the use of CMR to accurately document extensive cardiac involvement, which is usually discovered on autopsy alone. Four types of cardiac manifestations caused by Aspergillus have been described in the literature. First, Aspergillus may present as an intracavitary mass (aspergilloma), which is generally easily identified by echocardiography. Second, embolization of Aspergillus into coronary arteries causing myocardial infarction has been reported in a few cases. Third, intramyocardial abscesses (Figure 6) occur when the infection involves the myocardium with variable degree of invasion into endocardium, epicardium, and pericardium. Last, Aspergillus may cause prosthetic and native valvular endocarditis. Thus far, a comprehensive picture of the different intracardiac lesions has been derived from postmortem investigations only. In this case, neither computed tomography nor transthoracic echocardiography was able to detect the extensive myocardial involvement, whereas CMR allowed the visualization of the aspergilloma, of transmural infarction possibly related to embolization, and the identification of multiple intramyocardial abscesses, with characteristics similar to those reported in the literature from autopic series (Figure 6). To our knowledge, this is the first time that a noninvasive imaging modality has been able to visualize 3 of...
the 4 above-described typical manifestations of cardiac aspergillosis in a single patient. CMR may allow for an earlier diagnosis of cardiac aspergillosis in immunocompromised patients, potentially allowing earlier initiation of aggressive antifungal therapy resulting in improved prognosis.

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References

![Figure 4](image1.png)

**Figure 4.** Preoperative transthoracic and transesophageal echocardiographic images. **A,** Transthoracic 5-chamber view showing a large mass in the left ventricular outflow tract. **B,** Transesophageal long-axis view (113°) demonstrating the large mass partially prolapsing across the aortic valve in systole.

![Figure 5](image2.png)

**Figure 5.** Cardiac magnetic resonance findings showing cardiac manifestations of invasive aspergillosis. The scan was performed with a 3-Tesla magnet (Achieva TX, Philips Medical Systems, Best, the Netherlands). Cine steady-state free precession (SSFP) sequences and late gadolinium enhancement images after injection of 0.2 mg/kg of body weight of gadobutrol were acquired in short- and long-axis views of the left ventricle. **A,** SSFP cine images showing a large mobile mass adherent to the basal septum in the left ventricular outflow tract (black arrow). An intramyocardial abscess is seen as a reduction of myocardial signal intensity in the anterolateral wall (white arrow). **B,** Localized area of transmural late gadolinium enhancement in the apical lateral wall consistent with transmural scar (white arrow). A pericardial abscess is seen on the lateral wall (dashed white arrow). **C,** Late gadolinium imaging showing a myocardial abscess in the anterior wall as a circular hyperenhanced lesion with a hypodense core (arrow). **D,** Late gadolinium imaging showing a further myocardial abscess in the apical inferior wall (arrow). In addition, global pericardial and extensive pleural effusions are present.
Figure 6. Macroscopic pathological findings in cardiac aspergillosis, from Vaideeswar. A, Posterior surface of the heart covered by shaggy fibrinous exudates. Note ulcerated plaques (arrows). B, Right and left ventricular myocardium studded with numerous round abscesses.
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