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A case of nonvalvular endocarditis with biventricular apical infected thrombi

Anish Vani MD[1] | Monica Ahluwalia MD[1] | Robert Donnino MD[1,2,3] | Albert Jung MD, PhD[1] | Mikhail Vaynblat MD[4] | Larry Latson MD[2] | Muhamed Saric MD, PhD, FACC, FASE[1]

[1]Leon H. Charney Division of Cardiology, New York University Langone Health, New York, NY, USA

[2]Department of Radiology, New York University Langone Health, New York, NY, USA

[3]Veterans Affairs New York Harbor Healthcare System, New York, NY, USA

[4]Department of Cardiothoracic Surgery, New York University Langone Health, New York, NY, USA

Correspondence
Muhamed Saric, Noninvasive Cardiology, New York University, 560 First Avenue, New York, NY 10016, USA.
Email: muhamed.saric@nyulangone.org

Abstract

We report what appears to be the first case of biopsy-proven nonvalvular endocarditis with biventricular apical infected thrombi. A 47-year-old man presented with hypoxic respiratory failure from a multilobar pneumonia due to methicillin-resistant *Staphylococcus aureus* (MRSA). Transthoracic echocardiography and cardiac magnetic resonance imaging revealed biventricular apical masses suggestive of nonvalvular endocarditis with infected thrombi. Given concern for ongoing septic embolization to the lungs and brain despite appropriate antimicrobial therapy, the masses were surgically resected. Culture and histopathology confirmed MRSA-positive infected thrombi. In this case report, we highlight the differential diagnosis of apical masses and the role of multimodality imaging.

KEYWORDS

infective endocarditis, left ventricular thrombi, right ventricular thrombus

1 | INTRODUCTION

The differential diagnosis of intracardiac ventricular masses includes thrombus, tumor, and vegetation.[1] Left ventricular (LV) thrombus as a sequelae of acute anterior or apical myocardial infarction (MI) is a common etiology, especially in the prerevascularization era.[2] With antithrombotic therapy and percutaneous coronary intervention, however, there has been a significant decline in LV thrombus rates post-MI. Other conditions associated with intracardiac thrombus typically exhibit at least two of the three components of Virchow's triad (stasis, hypercoagulability, and endothelial injury). They may be observed in patients with dilated cardiomyopathies such as Chagas disease, takotsubo cardiomyopathy, and endomyocardial fibrosis.[3]

Cardiac tumors can either be primary or metastatic.[1] Primary tumors are rare, with a reported incidence of <1% found at autopsy. The vast majority of primary cardiac tumors are benign, composed primarily of myxomas in adults, and usually located in the left atrium and only 5% in the ventricles. Primary malignant tumors are typically sarcomas, which have a predilection for the right heart chambers. About 40 times more common than primary cardiac tumors are metastatic tumors, with pericardial predilection over myocardial involvement.

TABLE 1 Vital signs on presentation

Vital Signs	Values
Temperature	103.1°F
Heart rate	130 beats/min
Blood pressure	135/73 mm Hg
Respiratory rate	38 breaths/min
Oxygen saturation	84%

Nonvalvular intracardiac infection is uncommon.[4] It can occur in the setting of previously damaged myocardium or vascular intima, often in the setting of intravascular devices, grafts, or pacemakers. The infection can manifest as myocardial abscess, mural endocarditis, or superinfected tumor or thrombus. Mural endocarditis can be the result of seeding during bacteremia or fungemia, or extension from a myocardial abscess.

To the best of our knowledge, we are the first to report a case of nonvalvular endocarditis with biopsy-proven biventricular apical infected thrombi. Multimodal imaging including transthoracic echocardiography (TTE) and cardiac magnetic resonance imaging (MRI) played a pivotal role in this patient's care.

TABLE 2 Laboratory values on presentation

Laboratory Tests	Values (Normal Range)
White blood cell count	30.4 (4.2-9.1 × 10^3/μL)
Neutrophils/Eosinophils	87 (34%-68%)/0 (1%-7%)
Hemoglobin	14.2 (13.7-17.5 g/dL)
Platelets	26 (150-400 × 10^3/μL)
Blood urea nitrogen	88 (7-18 mg/dL)
Creatinine	2.41 (0.55-1.30 mg/dL)
Aspartate transaminase	144 (15-37 IU/L)
Alanine transaminase	71 (13-61 IU/L)
Alkaline phosphatase	191 (45-117 IU/L)
Gamma-glutamyl transferase	113 (5-85 IU/L)
International normalized ratio	1.5 (0.9-1.1 INR)
Prothrombin time	17.3 (10.4-13.2 sec)
Venous lactate	4.50 (0.90-1.70 mmol/L)
Troponin I	0.62 (peak) (<0.04 ng/mL)
Urine drug screen	Negative[a]

[a]Negative for amphetamines, barbiturates, benzodiazepines, tetrahydrocannabinol (THC), cocaine, methadone, opiates, and phencyclidine (PCP).

2 | CASE PRESENTATION

A 47-year-old undomiciled man, from the Caribbean with bipolar disorder, hypertension, and polysubstance abuse, presented with 2 weeks of lethargy, productive cough, and shortness of breath. In the emergency department, he was febrile, tachycardic, tachypneic, and hypoxic on room air [Table 1]. On examination, he was in acute distress, disoriented but with no focal neurologic deficit, and with diffuse coarse breath sounds. An electrocardiogram displayed sinus tachycardia with left ventricular hypertrophy and inferolateral ST depressions. Laboratory data revealed lactic acidosis, leukocytosis with neutrophil predominance, thrombocytopenia, hepatic impairment, acute kidney injury, coagulopathy, and a mildly elevated troponin [Table 2]. There was no eosinophilia.

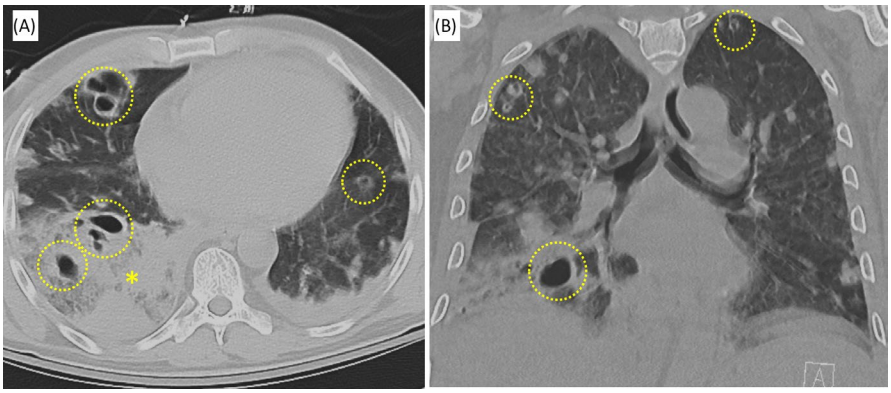

FIGURE 1 Computed tomography of the chest. Axial (Panel A) and coronal (Panel B) images from noncontrast CT chest on lung windows. Images show multiple bilateral solid pulmonary nodules, many of which demonstrate central cavitation (circles), findings compatible with pulmonary septic emboli. There is more dense confluent consolidation in the right lower lobe with areas of cavitation, consistent with a large pulmonary infarct (asterisk)

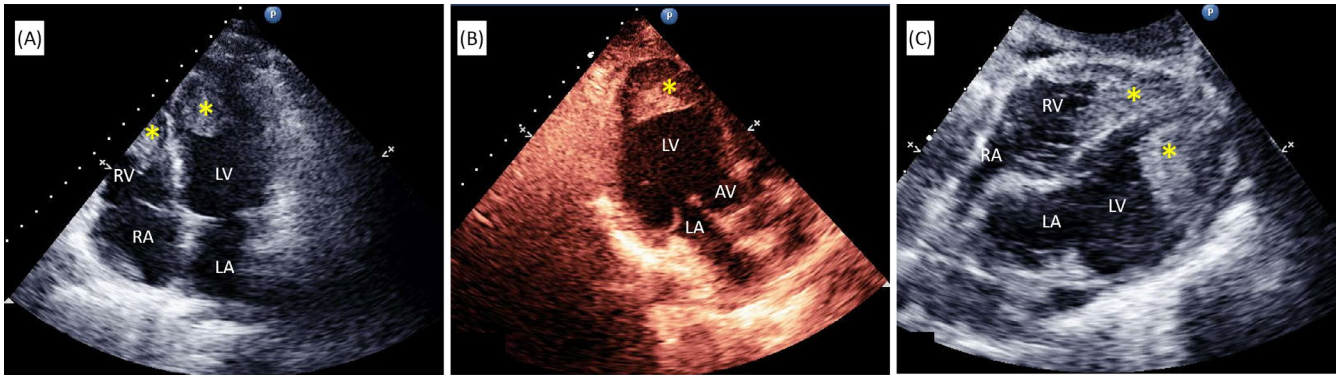

FIGURE 2 Transthoracic echocardiogram on hospital admission. Large left and right ventricular apical masses (asterisks) are visualized in the apical 4-chamber view (Panel A), apical 3-chamber view (Panel B), and subcostal view (Panel C). Movie S1 corresponds to this figure. Abbreviations: AV, aortic valve; LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle

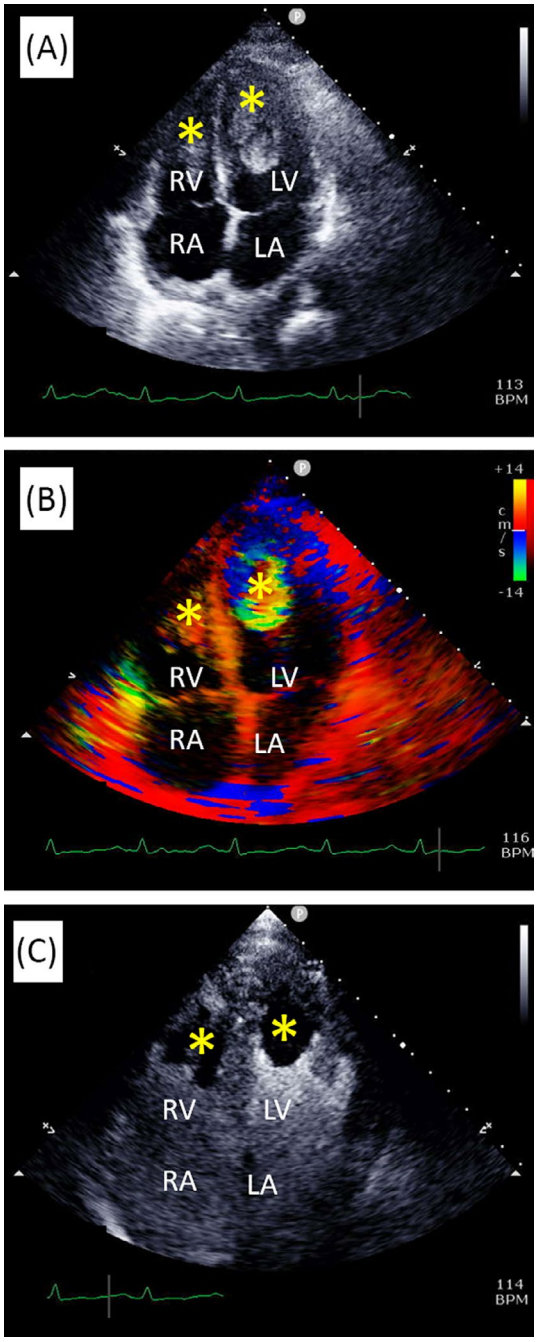

FIGURE 3 Repeat transthoracic echocardiogram. Left and right ventricular masses (asterisks) have now increased in size and complexity with central cavitations. They are visualized in the apical 4-chamber view in gray scale (Panel A), color tissue Doppler (Panel B), and after microbubble echo contrast injection. Note the absence of contrast uptake by the masses indicating their avascularity. Movie S2 corresponds to this figure. Abbreviations: LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle

Chest radiography demonstrated a multilobar pneumonia [Figure 1]. Subsequent computed tomography (CT) scan of the chest revealed multiple thick-walled cavitary lesions bilaterally indicative of septic emboli. The patient was treated with sepsis-dose intravenous normal saline, broad-spectrum antibiotics, and admitted to a critical care service. Four out of four blood culture bottles grew methicillin-resistant *Staphylococcus aureus* (MRSA). Noncontrast head CT scan and brain MRI revealed a left temporal intraparenchymal hematoma with moderate surrounding edema and multiple small acute to subacute cerebellar and supratentorial infarcts concerning for septic emboli. Cerebral angiography was negative for mycotic aneurysms.

Initial TTE [Figure 2, Movie S1] revealed akinesis of the apex and periapical left ventricular (LV) segments with a moderately decreased LV ejection fraction. Adherent to the endocardium of the LV apex, there was a large irregularly shaped mass measuring 2.4 × 2.2 cm. A smaller mass was adherent to the right ventricular (RV) apex. There was no significant valvular disease. Several days later, a repeat TTE [Figure 3, Movie S2] with microbubble contrast enhancement (sulfur hexafluoride lipid-type A microspheres, Lumason, Bracco Diagnostics Inc) revealed that the LV mass was now larger measuring 3.5 cm × 3.4 cm with multiple internal echo lucencies. An RV apical mass was again visualized. The masses appeared adherent to the endocardium rather than emanating from the myocardium and did not take up the contrast.

On cardiac MRI, the intracardiac masses appeared to be adherent primarily to the trabeculae [Figure 4, Movie S3]. The RV apical mass extended into the RV outflow tract. There was increased T2-weighted signal as well as late gadolinium enhancement in the adjacent apical subendocardium suggesting regional edema and/or inflammation. On first-pass contrast enhancement images, the masses did not enhance significantly, implying these were avascular structures. Overall, CMR findings were consistent with nonvalvular endocarditis with biventricular apical infected thrombi.

Due to ongoing embolization to the lung and brain despite appropriate antimicrobial therapy, the patient was referred for surgical resection of the intracardiac masses. After a midline sternotomy and initiation of cardiopulmonary bypass, a left ventriculotomy revealed an abscess with necrotic material occupying one third of the LV cavity. Through right atriotomy, another abscess in the RV with necrotic material was visualized. The infected material was resected from both ventricles. No thrombus or vegetation was seen on the valves. Histopathology of the surgically extracted masses revealed fibrin thrombi with purulent inflammation and bacterial colonies positive for MRSA on culture [Figure 5]. The patient's postoperative course was complicated by multiorgan failure, ultimately resulting in death.

3 | DISCUSSION

The presence of nonvalvular endocarditis is rare; the presence of biopsy-proven biventricular apical infected thrombi has not been previously reported. We suspect our patient was severely bacteremic for a prolonged period of time, resulting in myocardial injury and subsequent infected thrombus formation. The source of his MRSA bacteremia was likely due to intravenous drug abuse. The concern for ongoing embolization to the lungs and brain despite appropriate

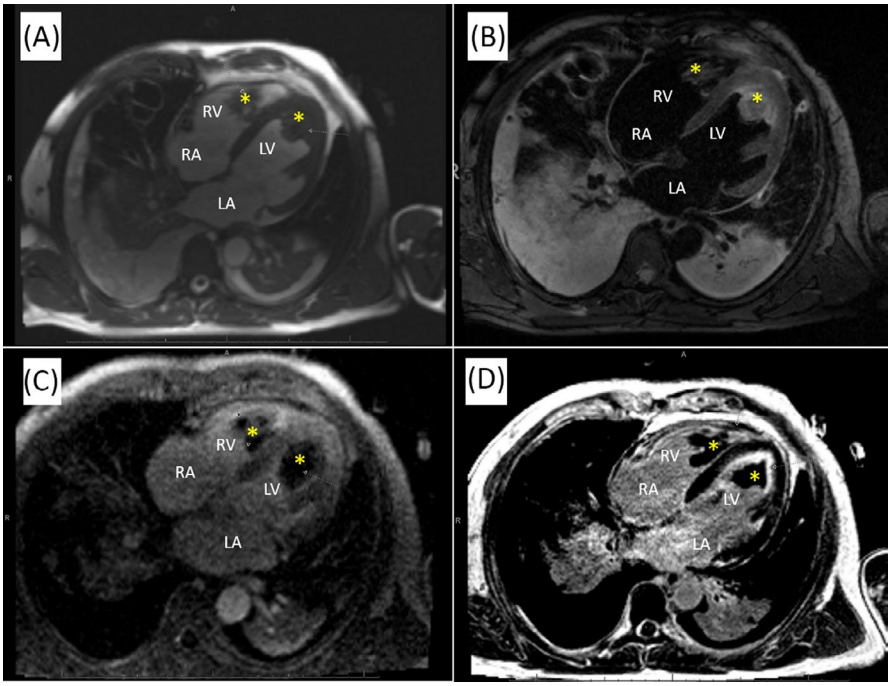

FIGURE 4 Cardiac magnetic resonance imaging. Biapical endocarditis with overlying thrombi (asterisks). Panel A: Four-chamber view revealing multiple mobile and deformable masses in the ventricular apices. Panel B: T2-weighted imaging with increased subendocardial signal around the mass consistent with edema and inflammation. Panel C: First-pass contrast enhancement imaging revealing that the masses are avascular. Panel D: Late gadolinium enhancement in the apical subendocardium also indicative of inflammation. Movie S3 corresponds to Panel A. Abbreviations: LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle

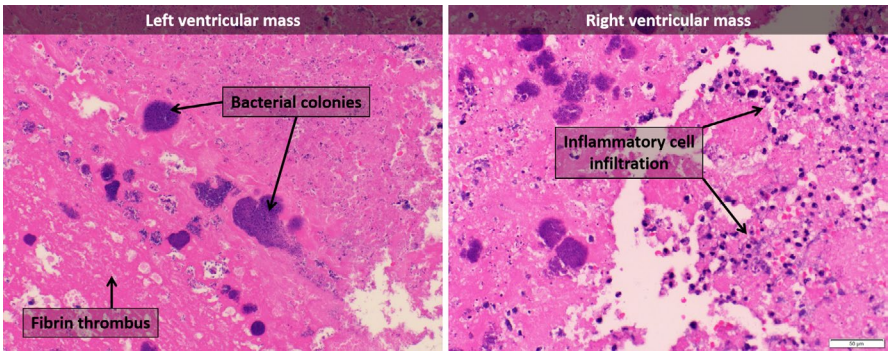

FIGURE 5 Histopathology. Surgically resected intracardiac masses revealing infected thrombi on hematoxylin and eosin staining. Courtesy of Navneet Narula, MD; Department of Pathology, New York University Langone Health, New York, NY, USA

antimicrobial therapy prompted a multidisciplinary discussion and decision to proceed with surgical resection of the intracardiac masses.

Reported cases of nonvalvular infected ventricular thrombi are uncommon. Two case reports involving methicillin-sensitive *Staphylococcus aureus* (MSSA) infected thrombi appeared to show successful outcomes with medical management alone, although one was not deemed to be a surgical candidate and remained in the intensive care unit for 2 months; neither case described embolic events.[5,6] In another case, a young intravenous drug abuser with MSSA bacteremia was suspected to have biventricular nonvalvular endocarditis resulting in multiple embolic events and quickly succumbed to pulseless electrical activity cardiac arrest.[7] Among a review of 14 patients who underwent surgical resection of an infected ventricular thrombus, 10 survived; 3 deaths occurred intra-operatively or immediately postoperatively, while 1 death occurred 2 months later due to heart failure.[8]

The role of transthoracic echocardiography is critical in the diagnosis of intracardiac masses, with a reported sensitivity of 93%.[9] The cases in which the mass was missed were attributed to a small mass size and/or difficult location for visualization, such as in the pericardium or posterior surface. Echocardiography can be used to characterize the location, attachment, shape, size, and mobility of the mass.[1] Additionally, echocardiography can be used to hemodynamic parameters to assess whether the mass obstructs a valve or outflow tract. Differentiating between avascular thrombus from tumor can often be more challenging, but can be augmented with the use of microbubble contrast agents, as was used in our case.[10] Other complementary imaging modalities such as cardiac MRI have been show to provide incremental value. Cardiac MRI can provide larger fields of view, better characterize the mass tissue, and help to detail its relationship to other cardiac structures prior to surgical resection.[11]

4 | CONCLUSION

Intracardiac ventricular apical masses are uncommon; the differential diagnosis includes thrombus, tumor, or vegetation. Multimodality imaging, such as transthoracic echocardiography and cardiac magnetic resonance imaging, can be used to identify

the presence of intracardiac masses and characterize the mass prior to surgical resection. Nonvalvular endocarditis is a rare phenomenon, and the presence of biopsy-proven biventricular apical infected thrombi has not been previously reported. Such a finding in the setting of ongoing embolic events warrants a multidisciplinary discussion to guide the best course of management for the patient.

ORCID

Anish Vani https://orcid.org/0000-0001-7220-7439
Monica Ahluwalia https://orcid.org/0000-0002-4487-731X
Muhamed Saric https://orcid.org/0000-0001-7682-3749

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

Movie S1A. Transthoracic echocardiography on hospital admission revealed large left and right ventricular apical masses (asterisks) in apical 4-chamber (A), apical 3-chamber (B), and subcostal views (C).

Movie S1B

Movie S1C

Movie S2A. Repeat transthoracic echocardiogram demonstrated that the left and right ventricular masses (asterisks) have now increased in size and complexity with central cavitations. They are visualized in the apical 4-chamber view in gray scale (A), color tissue Doppler (B), and after microbubble echo contrast injection (C). Note the absence of contrast uptake by the masses indicating their avascularity.

Movie S2B

Movie S2C

Movie S3. Cardiac magnetic response imaging, cine four-chamber view revealing multiple mobile and deformable masses in the ventricular apices.

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