

## MINI-FOCUS ISSUE: HEART FAILURE

BEGINNER

## CASE REPORT: CLINICAL CASE

# Left Ventricular Thrombus Formation in the Setting of Normal Systolic Function



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## ABSTRACT

We describe the case of a 42-year-old female with recurrent left ventricular (LV) thrombus and multiple embolic events despite having normal LV systolic function. The clinical presentation, associated conditions, diagnostic evaluation and treatment of patients with LV thrombus in the setting of normal LV systolic function are discussed.

(**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2020;2:1470-4) © 2020 The Authors.

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## HISTORY

A 42-year-old female presented to another hospital after she was found unconscious at home. Vital signs on arrival at the hospital were a pulse of 72 beats/min, respiratory rate of 18 breaths/min, blood pressure of 131/70 mm Hg, and oxygen saturation of 94% on room air. Physical examination was remarkable for normal breath sounds and normal heart sounds without

murmurs, rubs, or gallops. She was awake and oriented with slurred speech. Her strength was 5/5 in the left upper and lower extremities and 4/5 in the right upper and lower extremities. Cranial nerves II through XII, and sensation throughout her extremities and reflexes were intact. She was in rhabdomyolysis with acute kidney injury and had altered mental status. Cardiac magnetic resonance showed regions of acute and subacute extension of a chronic right frontal lobe infarct, with a distribution concerning for a proximal embolic source.

## LEARNING OBJECTIVES

- To review the clinical presentation of patients with LV thrombus in the setting of normal LV systolic function.
- To understand underlying conditions that have been associated with the development of LV thrombus in the setting of normal LV systolic function.
- To review the evaluation and management of patients with LV thrombus in the setting of normal LV systolic function.

## MEDICAL HISTORY

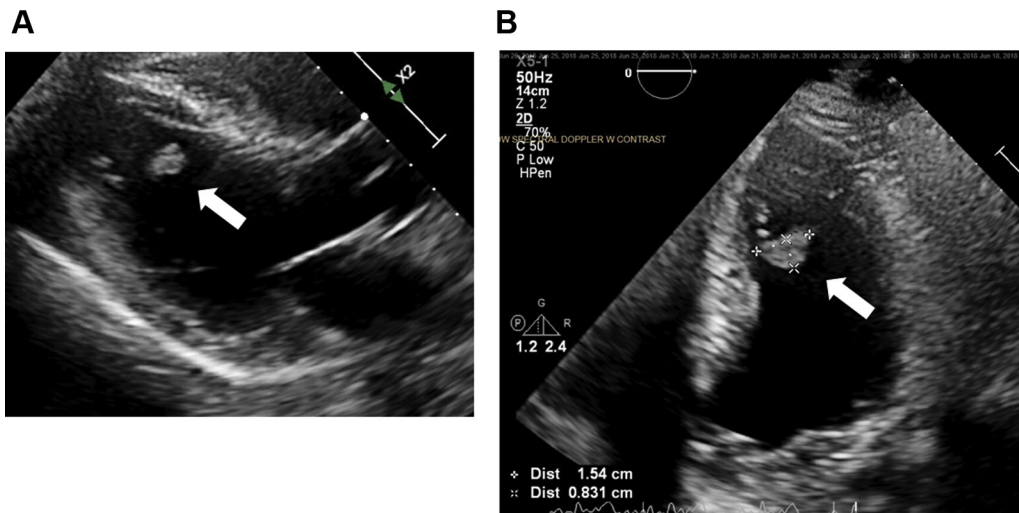
The patient had hypertension, hyperlipidemia, type 2 diabetes, chronic kidney disease, and a 4-year history of multiple cerebrovascular accidents (CVA) and used tobacco. A left ventricular (LV) mass had been identified 2 years previously, and the patient was treated with aspirin and rivaroxaban for an unknown period of time. She had stopped taking rivaroxaban due to financial concerns.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Case Reports* [author instructions page](#).

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**FIGURE 1** Echocardiography from Parasternal Long-Axis and Apical 4-Chamber Views Showing Left Ventricular Thrombus



Echocardiographic images from parasternal long-axis (A) and apical 4-chamber (B) views showing a mass in the left ventricle (arrow).

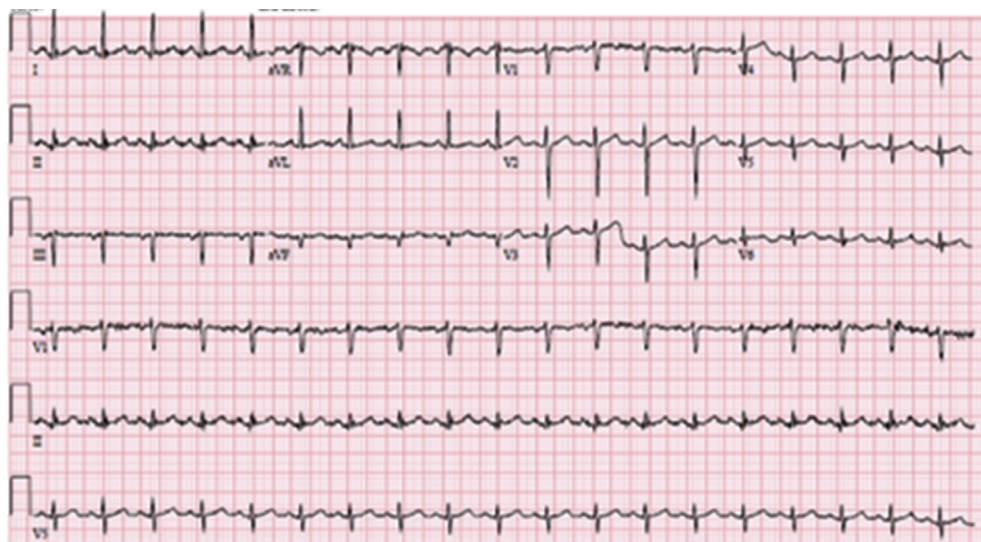
## DIFFERENTIAL DIAGNOSIS

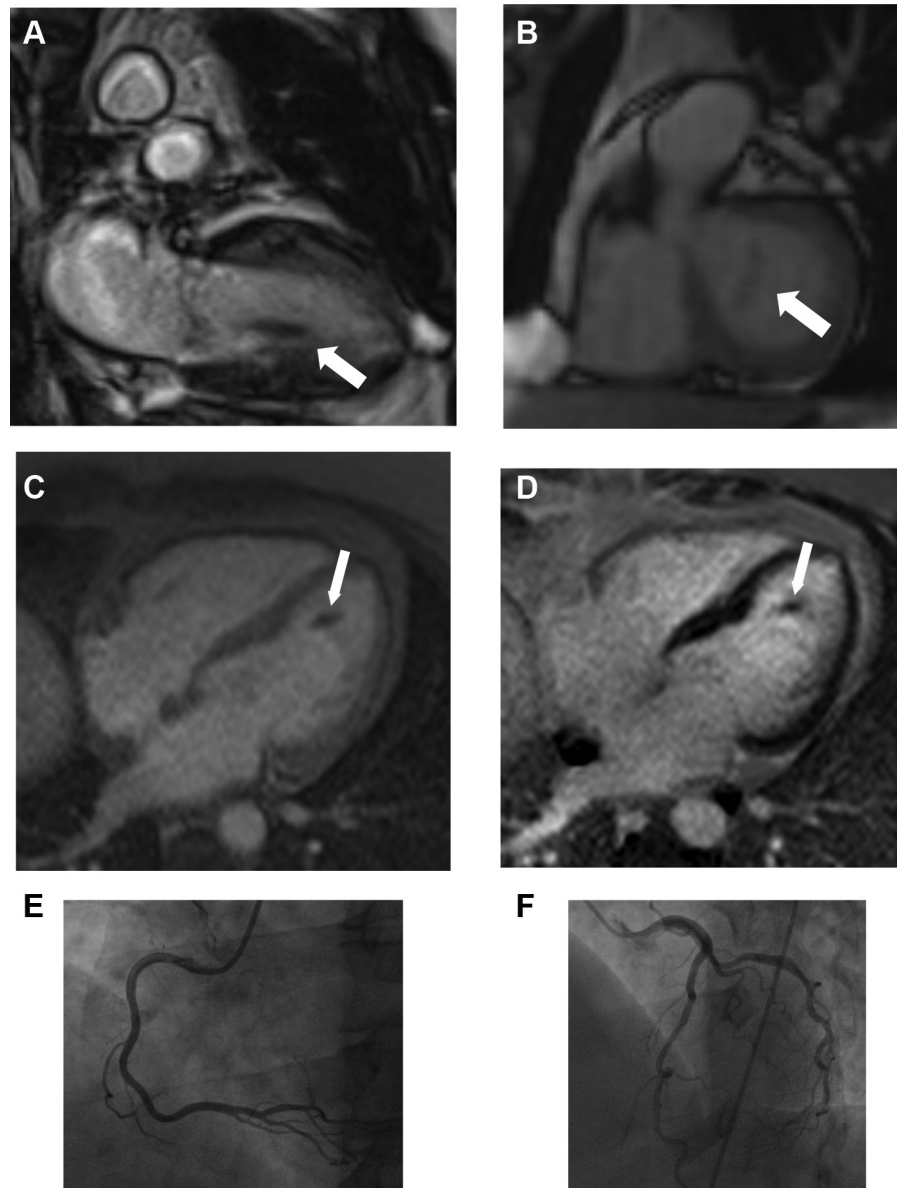
Given her history of LV thrombus and multiple CVAs, the most likely cause was recurrent LV thrombus with embolization. Other potential causes of CVA in a 42-year-old female would include paroxysmal atrial fibrillation, deep vein thrombosis with a patent foramen ovale or atrial septal defect, vasculitis, and intracerebral pathology.

## INVESTIGATIONS

An echocardiogram showed no valvular abnormalities, normal LV systolic function with an ejection fraction of 55% to 60%, and a pedunculated mobile 2.5- × 0.9-cm mass at the apex of the LV (Figure 1, Video 1). Electrocardiography showed sinus tachycardia without ischemic changes (Figure 2). Cardiac magnetic resonance confirmed the presence of an LV

**FIGURE 2** Electrocardiography on Admission Shows Sinus Tachycardia But No Ischemic Changes



**FIGURE 3** Results of Cardiac Magnetic Resonance Imaging and Coronary Angiography

Cardiac magnetic resonance images from vertical long axis (A) and short axis (B) views demonstrate a left ventricle mass without perfusion (C) or late gadolinium enhancement (D). Angiography of the right (E) (left anterior oblique view) and left (F) (left anterior oblique cranial view) coronary arteries showed no evidence of obstructive coronary artery disease.

mass and normal LV systolic function (Figures 3A and 3B, Video 2). Perfusion sequence imaging showed no perfusion in the mass (Figure 3C), and late gadolinium imaging with inversion time (TI) of 270 (Figure 3D) or TI of 700 (image not shown) showed no enhancement and a low signal. These findings are highly suggestive of thrombus as most cardiac tumors will take up gadolinium (1). Angiography showed a mild narrowing in the proximal left circumflex artery but no

evidence of significant coronary artery disease (Figures 3E and 3F). Bilateral popliteal artery thrombi were identified and suspected to be an embolic complication from the LV thrombus.

Hematology evaluation found no evidence of a hypercoagulable state. Protein S and protein C activity levels were in the normal range (reference range, 83% to 123%). Factor V Leiden and factor II gene mutations were not present. Levels of  $\beta$ -2

glycoprotein immunoglobulin G (IgG) and IgM antibodies and anti-cardiolipin IgG and IgM antibodies were within normal limits. There was no evidence of a lupus anticoagulant. The patient denied any family history of clotting disorders. Age-appropriate screening for malignancy was unremarkable, including a mammogram, a Papanicolau smear, and stool testing for occult blood.

### MANAGEMENT

The patient underwent a thoracotomy with removal of a 2.5- × 1-cm mass lodged between the posterior medial papillary muscle, the crossing bands, and the septal wall. Pathological examination was consistent with an organizing thrombus. The patient's rhabdomyolysis-induced acute kidney injury resolved. The patient was discharged to a long-term care facility on rivaroxaban.

### DISCUSSION

LV thrombus with normal LV systolic function is rare, with only 31 cases reported in the medical literature. For these cases, the median age was 43 years (range: 39 to 60 years), with a slight male predominance (58%). The majority of patients presented with embolic complications (27 of 31 [87%]). Unlike the situation with the present patient, most cases occurred in the setting of an identifiable medical condition that carries an increased risk of thrombosis including connective tissue disease, ulcerative colitis, rheumatoid arthritis, Crohn's disease, vasculitis, acute febrile neutrophilic dermatosis, or a malignancy (Table 1). No discernable predisposing factors were identified in the current patient.

The apex appears to be uniquely susceptible to LV thrombus formation. Most LV thrombi in patients with normal LV systolic function occur at the apex, with other locations in the septum and the mitral valve apparatus. The apex is also the most common site of thrombus in patients with myocardial infarction (2).

Treatment generally includes anticoagulation with or without surgical removal or systemic thrombolysis. There are no studies or guidelines to guide treatment of LV thrombus in patients with normal LV systolic function, but some insight can be gained from examining recommendations for treatment of LV thrombus in patients with compromised LV function. The 2013 American College of Cardiology Foundation/American Heart Association ST-segment elevation myocardial infarction (STEMI) guidelines and the 2014 American Heart Association/American Stroke Association stroke-prevention guidelines recommend treatment with a vitamin K antagonist for 3 months

**TABLE 1** Disease States Reported in Patients with Left Ventricular Thrombus in the Setting of Normal Left Ventricular Systolic Function

Inflammatory conditions	Connective tissue disease Ulcerative colitis Rheumatoid arthritis Crohn's disease Takayasu arteritis Acute febrile neutrophilic dermatosis (Sweet syndrome)
Malignancies	Breast cancer Myelogenous leukemia Metastatic oat cell carcinoma of the lung T-cell lymphoma
Blood dyscrasias	Hypereosinophilia Essential thrombocythemia Myelofibrosis
Hypercoagulable states	Lupus anticoagulant
Medications	Tamoxifen Erythropoietin Cocaine use
Miscellaneous	Pheochromocytoma Congenital hepatic fibrosis

with goal INR values of 2 to 2.5 or >2.5, respectively (3). The 2017 European Society of Cardiology STEMI guidelines advise treatment with a vitamin K antagonist for up to 6 months. The American Heart Association/American Stroke Association guidelines noted that dabigatran, rivaroxaban, or apixaban could be considered alternatives to vitamin K antagonists. Recurrence of LV thrombus and/or recurrent embolic events, as seen in the current case, have been previously reported in patients with LV thrombus and normal LV systolic function, suggesting that long-term anticoagulation may be needed (4-6).

### FOLLOW-UP

At 12 months follow-up, the patient had not experienced any more thrombotic or embolic complications, and repeated echocardiography showed no recurrence of the LV mass and normal ventricular function. She continued to take rivaroxaban on a daily basis.

### CONCLUSIONS

LV thrombus rarely occurs in patients with normal LV systolic function but is associated with a high rate of embolic complications. The cause is not clear, although most patients have an underlying malignancy, inflammatory condition, blood dyscrasia, or prothrombotic state. Recurrent thrombi have been reported in several patients suggesting that prolonged anticoagulation may be necessary.

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**KEY WORDS** cardiac magnetic resonance, echocardiography, thrombus

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**APPENDIX** For supplemental videos, please see the online version of this paper.