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Case Report

Thromboembolic trapping and anticoagulation dilemma in a patient with heart failure and reduced ejection fraction in sinus rhythm: A case report ☆,☆☆

Jing Yang^a, Mingjun Deng^{b,#}, Jing Li^{a,*}^a Department of Cardiology, Gansu Provincial Hospital, Lanzhou 730000, China^b Department of Cardiology, Qingyang First People's Hospital, QingYang 745000, China

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ABSTRACT

Severe left ventricular dysfunction and ventricular wall motion abnormalities predispose individuals to thrombosis and thromboembolism. Thromboembolism is one of the main causes of increased mortality in patients with heart failure and reduced ejection fraction (HFrEF). However, regarding thromboembolism due to HFrEF in sinus rhythm, most cases to date have reported ischemic strokes, and repeated embolization of peripheral arteries has been reported not uncommon. Herein, we report the case of a 48-year-old man with a definite diagnosis of sinus rhythm HFrEF and recurrent peripheral arterial embolization within a short period. The condition is caused by severe left ventricular systolic dysfunction and abnormal left ventricular wall motion, resulting in blood stasis and abnormal blood composition, with or without left ventricular thrombosis, and can lead to thromboembolism. Current guidelines state that patients with heart failure and clear indication(s) for anticoagulation (e.g., atrial fibrillation, heart valve replacement) should be administered appropriate anticoagulation therapy. However, controversy persists regarding whether patients with HFrEF in sinus rhythm can benefit from anticoagulation therapy. This case highlights the utility and necessity of anticoagulation for the prevention of intracardiac thrombosis and the treatment of peripheral arterial embolism in patients with HFrEF in sinus rhythm.

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* Corresponding author.

E-mail address: donotsettle@126.com (J. Li).

The author contributed to the work equally and should be regarded as co-first authors.

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Introduction

Heart failure (HF) is the end-stage manifestation of various cardiovascular diseases and has become an important public health problem. With the continuous improvement of modern diagnosis and treatment, the hospitalization time and survival rate of HF have been greatly improved, although the mortality rate remains high [1]. Study data show that 30% of patients with HF experience thromboembolic events of different types, leading to an increase in overall patient mortality [2]. Thromboembolism is a non-negligible complication in patients with HF, which has a very high disability and mortality rate and seriously affects prognosis.

The most common method of classifying HF is based on left ventricular ejection fraction (LVEF). The European Society of Cardiology defines LVEF <40% as HF with reduced ejection fraction (HFrEF) [3]. It has been demonstrated that LVEF is significantly negatively correlated with the incidence of thromboembolism [4]. The pathophysiologic mechanisms of HF patients result in a hypercoagulable state of the blood with a high risk of thromboembolism, providing a theoretical basis for anticoagulant therapy in HF patients. However, there are few studies to date on anticoagulation in HFrEF patients with sinus arrhythmia, and there is no consensus on whether prophylactic anticoagulation should be performed in these patients. We present a patient with HFrEF in sinus rhythm with recurrent peripheral arterial embolic events and significant benefit from anticoagulation.

Case presentation

A 48-year-old man was admitted to hospital with right lower extremity pain and intermittent claudication for >20 days. The patient denied any history of hypertension, diabetes mellitus, or AF, or a family history. The patient was diagnosed with dilated cardiomyopathy 7 years previously and had been taking anti-HF medication for 1 year before stopping on his own. Physical examination revealed an enlarged left heart border with apical beats moving to the lower left. Edema was present in both lower extremities, with elevated skin temperature on the right side. Computed tomography (CT) angiography of the lower extremities revealed thrombosis of the right popliteal, right posterior tibial, and right anterior tibial arteries (Fig. 1). The patient was administered enoxaparin sodium (6000 U) subcutaneously every 12 h. Electrocardiography (ECG) revealed sinus rhythm of 83 beats/min, normal cardiac axis, incomplete intra-atrial block, indeterminate intraventricular block, and ST-T changes. Echocardiography revealed enlarged left heart chambers, abnormal left ventricular wall motion, slow apical flow, moderate mitral regurgitation, severe tricuspid regurgitation, severely elevated pulmonary artery pressure, moderately diminished right ventricular systolic function, diminished left ventricular systolic function, and an ejection fraction of 29% (Fig. 2). Ultrasound of the veins of both lower extremities revealed patent lumen without thrombosis. Laboratory investigations revealed a D-dimer level of 0.98 $\mu\text{g/ml}$ (normal range

<0.5 $\mu\text{g/ml}$) and an N-terminal-pro B-type natriuretic peptide (NT-proBNP) level of 2235 pg/ml (normal range <125 pg/ml). Other indicators of hypercoagulability (e.g., renal function, autoantibodies, and coagulation function) were all negative.

Multidisciplinary physicians recommended percutaneous lower extremity angioplasty and thrombus aspiration as first-line interventions to relieve the patient's clinical symptoms. Because the diagnosis of arterial thrombosis was confirmed and there were no existing co-morbidities with a clear anticoagulant index, aspirin bypass (100 mg once daily) was administered out of hospital. The patient's blood pressure was intolerant to enkephalinase inhibitors and angiotensin-converting enzyme inhibitors; as such, a cardiologist recommended out-of-hospital dagliflozin (10 mg/day), metoprolol extended-release tablets (11.875 mg/day), and spironolactone (20 mg/day) to optimize individualized treatment for HF. Blood pressure was closely monitored out-of-hospital, and after 3 weeks of medication, the patient's blood pressure fluctuated at approximately 85/50 mmHg, forcing him to discontinue the anti-HF medication.

Unfortunately, 1 week after stopping the medication, the patient visited the hospital again for sudden severe abdominal pain and a 2-day history of numbness of the right lower limb. On physical examination, the apical beat was shifted downward to the left, and the heart rate was increased; additionally, abdominal pressure, rebound pain, abdominal muscle tension, and decreased bowel sounds were noted. Edema of both lower extremities was noted. CT of the mesenteric artery revealed embolization of the middle and distal portions of the superior mesenteric artery, and the distal branches were not visualized. CT of the lower extremity arteries revealed multiple thromboses of the right common iliac artery, external iliac artery, and bilateral internal iliac arteries, which were newly developed compared with the scan 1 month earlier (Fig. 3). There were no significant dynamic changes in the patient's ECG compared with that at 1 month previously, and NT-proBNP and D-dimer levels were > 35,000 pg/ml and 3 $\mu\text{g/ml}$, respectively. Accordingly, based on the history and ancillary investigations, we strongly suspected cardiogenic embolism. The patient was found to have a cardiac thrombus in the left ventricle at the apex of the left ventricle. Subsequent bedside echocardiography revealed a mobile thrombus, measuring 13 × 20 mm, in the apical region of the left ventricle, which confirmed our suspicions.

The family and the patient were informed of the current critical condition and the need for urgent treatment to prevent further intestinal necrosis. On the day of admission, the patient underwent emergency exploratory laparotomy, which revealed black tissue and extensive necrosis from 50 cm below the flexor ligament of the small intestine to 15 cm above the ileocecal portion of the ascending colon (Fig. 4). Intraoperative diagnosis was mesenteric artery thrombosis with intestinal necrosis. Intestinal resection anastomosis was performed, and postoperative anticoagulation, acid suppression, rehydration, correction of HF, and other symptomatic treatments were administered. The patient was discharged from hospital and experienced good postoperative recovery. Out-of-hospital anticoagulation with rivaroxaban tablets (20 mg once daily) was standardized. Two months after the operation,

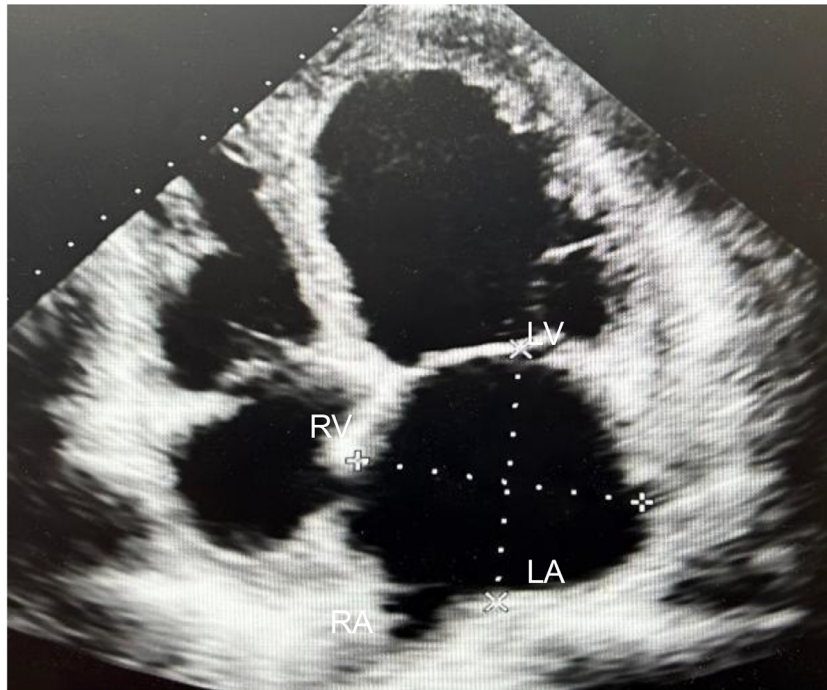


Fig. 1 - The echocardiogram showed significant enlargement of the left cardiac chamber . LV, Left ventricle; RV, Right ventricle; LA, Left atrium; RA, Right atrium.

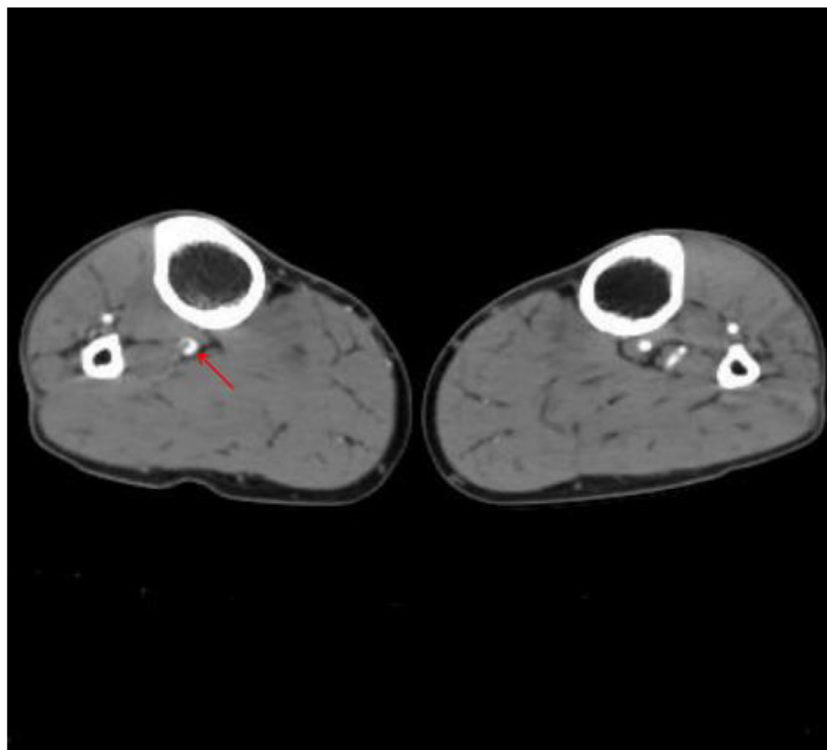


Fig. 2 - The red arrow indicates thrombus in the right posterior tibial artery.

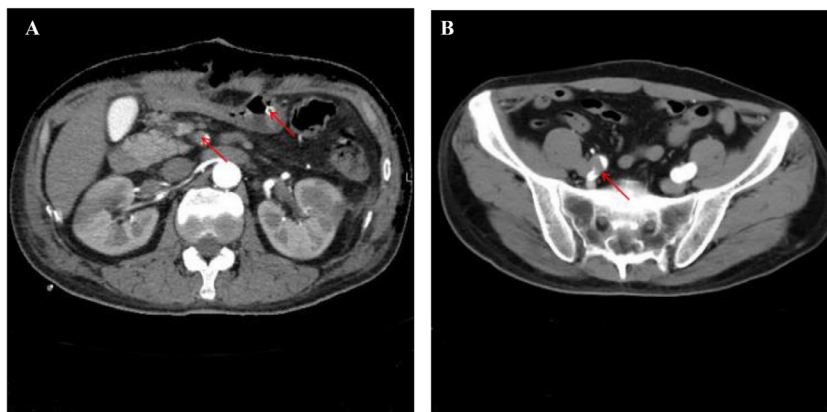


Fig. 3 – On the left, the red arrow indicates mesenteric artery thrombosis; The red arrow in the right image indicates a thrombus in the common iliac artery.

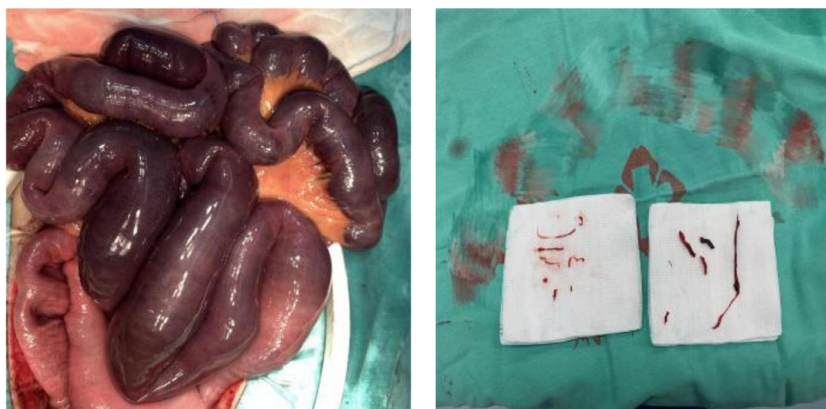


Fig. 4 – The left image shows ischemic necrotic bowel; On the right is a thrombus taken from a mesenteric artery.

the patient exhibited no obvious symptoms of shortness of breath, abdominal pain, or lower limb pain in the activities of daily living. Echocardiography revealed that the intracardiac thrombus had disappeared, and there was no new thrombus formation in the lower extremity arteries. Currently, the patient remains under close follow-up at the cardiovascular disease and vascular surgery clinic.

Discussion

Studies have shown that the incidence of left ventricular thrombus (LVT) in patients with HFrEF in sinus rhythm ranges from 11% to 44% [4]. Severe ventricular systolic dysfunction and localized ventricular wall retardation lead to slow blood flow and blood stasis, thereby increasing the risk for intracardiac thrombosis [5]. In addition, the prolonged residence time of HF platelets in the ventricles leads to increased platelet activation and coagulation factor activity, and abnormalities in blood composition also promote thrombosis. Erbay et al. [6] confirmed that there were no significant differences in platelet activity, prothrombin activity, and fibrinolysis in patients with dilated cardiomyopathy with or without com-

bined LVT [7]. This suggests that even thrombi that are imperceptible on echocardiography have a high risk for thromboembolism.

In this case, the patient's LVEF on cardiac magnetic resonance imaging on the second admission was 16.7%, which is a significant decrease in left ventricular systolic function compared with the first admission. As ventricular systolic dysfunction worsens, changes in hemodynamic factors, such as decreased cardiac output and decreased blood pressure, can also promote intracardiac thrombus formation and dislodgement. The 2 ischemic events in this patient manifested on imaging as thromboembolisms, which consisted mainly of blood clots. Therefore, anticoagulants may be more effective than antiplatelet agents in reducing ischemic events.

Nevertheless, current guidelines recommend the use of anticoagulants in patients with atrial fibrillation or other patients with anticoagulant pointers (e.g., history of thromboembolism or prosthetic valve replacement). The benefit of anticoagulation in patients with HFrEF in sinus rhythm remains controversial. This case report strengthens the evidence supporting screening of patients with HFrEF in sinus rhythm who may benefit from anticoagulation. Until more definitive data are available, anticoagulation should be considered in patients at high risk for HFrEF, including those with

acute decompensation, very low LVEF, intracardiac removable thrombus, chronic ischemic heart disease, high D-dimer level, and previous thromboembolic events [8,9].

Conclusions

HFrEF in sinus rhythm is a well-recognized risk factor for thromboembolic disease, making early assessment of the use of anticoagulants in individual patients important. However, there is still no broad consensus in this area; as such, large prospective clinical studies are needed to provide reliable clinical data to develop appropriate treatment standards. It is hoped that this case report will draw sufficient attention from clinicians to this condition and prompt future clinical studies with large sample sizes.

Patient consent

We would like to submit the enclosed manuscript entitled “Thromboembolic trapping and anticoagulation dilemma in a patient with heart failure and reduced ejection fraction in sinus rhythm: A case report”, which was submitted to Radiology Case Report. The case was rare reported and these imaging modalities should be informative and educational for general physicians.

We assure that we have informed patients not to disclose personal information of patients, and the article is only used for medical communication, not for commercial purposes. It was also confirmed that written informed consent for the publication of this journal was obtained from the patient. Thanks!

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