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VALVULAR HEART DISEASE

CASE REPORT: CLINICAL CASE

Role of Multimodality Images to Diagnose and Follow-Up Recurrent Rheumatic Myocarditis

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ABSTRACT

Rheumatic heart disease is an immune disorder that may occur as a complication of rheumatic fever. Diagnosing the reactivation of rheumatic carditis is a challenge, particularly in older individuals. We report a 43-year-old woman who experienced recurrent rheumatic myocarditis. The diagnosis, treatment, and follow-up were enabled by the use of multimodal imaging techniques. (JACC Case Rep. 2024;29:102629) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 43-year-old woman presented with chest pain and dyspnea NYHA functional class III symptoms. During the physical examination, rales were noted at the lung bases, along with jugular venous distension, hepatojugular reflux, and peripheral edema.

LEARNING OBJECTIVES

- To recognize, based on clinical presentation, active rheumatic myocarditis.
- To comprehend the clinical management of rheumatic myocarditis.
- To understand the role of multimodality imaging examinations on follow-up and management of recurrent rheumatic myocarditis.

MEDICAL HISTORY

Twenty years before her current presentation, the patient underwent mechanical mitral prosthesis implantation because of severe rheumatic regurgitation. Benzathine penicillin G (1,200,000 U intramuscularly every 21 days) had been prescribed since age 10 years for secondary prophylaxis, with irregular intake. Additionally, the patient had a previous cardioembolic myocardial infarction in 2018 due to atrial fibrillation.

DIFFERENTIAL DIAGNOSIS

Considering the new onset of heart failure symptoms, some hypotheses emerged, such as prosthesis dysfunction, ischemic heart disease, viral myocarditis,

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ABBREVIATIONS AND ACRONYMS

^{18}F-FDG PET/CT = ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography

FDG = fluorodeoxyglucose

MRI = magnetic resonance imaging

NR = normal range

RC = rheumatic carditis

RF = rheumatic fever

RHD = rheumatic heart disease

SUV_{max} = maximum standardized uptake value

cardiac sarcoidosis, and recurrence of rheumatic carditis (RC).

INVESTIGATIONS

Blood test revealed a white blood cell count of 7,700/mm^3 (normal range [NR]: 3,500-10,500/mm^3), hemoglobin of 11.3 g/dL (NR: 12-15 g/dL), platelet count of 228,000/mm^3 (NR: 150,000-450,000/mm^3), and C-reactive protein of 8.1 mg/L (NR: 1-3 mg/L). Electrocardiogram showed atrial fibrillation and a heart rate of 85 beats/min. A chest x-ray showed a slightly increased cardiothoracic index, mechanical prosthesis in the mitral position, and cephalization of the pulmonary vessels. Based on clinical heart failure presentation, a transthoracic echocardiogram was performed, revealing a severe reduction in the left ventricular ejection fraction from 54% to 36%, despite no mitral mechanical prosthesis or valvular dysfunctions.

To investigate myocardial involvement in a high-risk rheumatic patient, an ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F-FDG PET/CT) was performed (Figure 1), preceded by a high-fat and no-carbohydrate diet 24 hours before the examination and followed by 12 hours of fasting.[1] The patient had a nursing follow-up for reinforcement of the dietary instructions. ^{18}F-FDG PET/CT demonstrated a moderate and diffusely heterogeneous uptake of the radiopharmaceutical in all left ventricular walls (maximum standardized uptake value [SUV_{max}]: 5.4), which was a similar pattern as demonstrated in previous RC studies and different from typical cardiac sarcoidosis findings, which include focal areas of fluorodeoxyglucose (FDG) uptake.[2] The cardiac sarcoidosis investigation did not reveal clinical evidence that usually supports this diagnosis, such as mediastinal and/or hilar lymphadenopathy, hypercalcemia or abnormal vitamin D metabolism, hepatosplenomegaly, extracardiac FDG uptake on ^{18}F-FDG PET/CT, and history of arrhythmic events.[2]

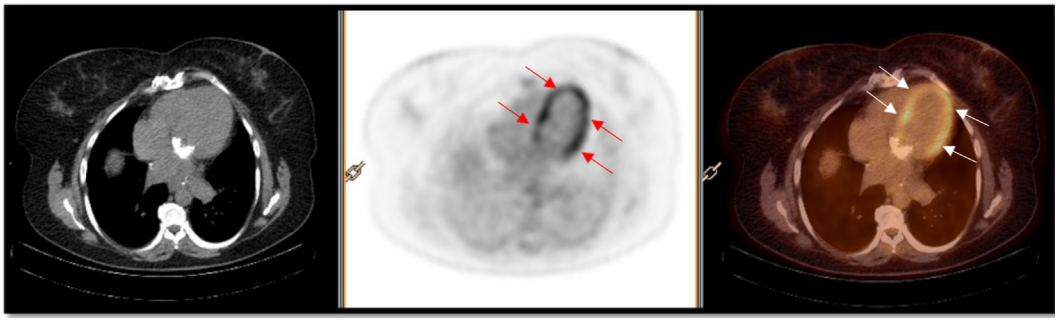
To rule out differential diagnoses, cardiac magnetic resonance imaging (MRI) was performed and revealed anteroseptal and midapical ischemic patterns of late gadolinium enhancement, compatible with a previous myocardial infarction (Figure 2A). There was no evidence of myocardial edema or signs of acute inflammatory process (transverse relaxation time mapping of 46 ms [NR: <50 ms]) or any other enhancement pattern suggestive of viral myocarditis (Figure 2B). Additionally, cardiac biopsy was considered but was declined by the patient.

MANAGEMENT

Active RC was highly suspected because of the patient's history of rheumatic heart disease (RHD), and oral prednisone was prescribed at the dosage of 80 mg daily. It was gradually reduced after 4 weeks, with complete resolution of symptoms.

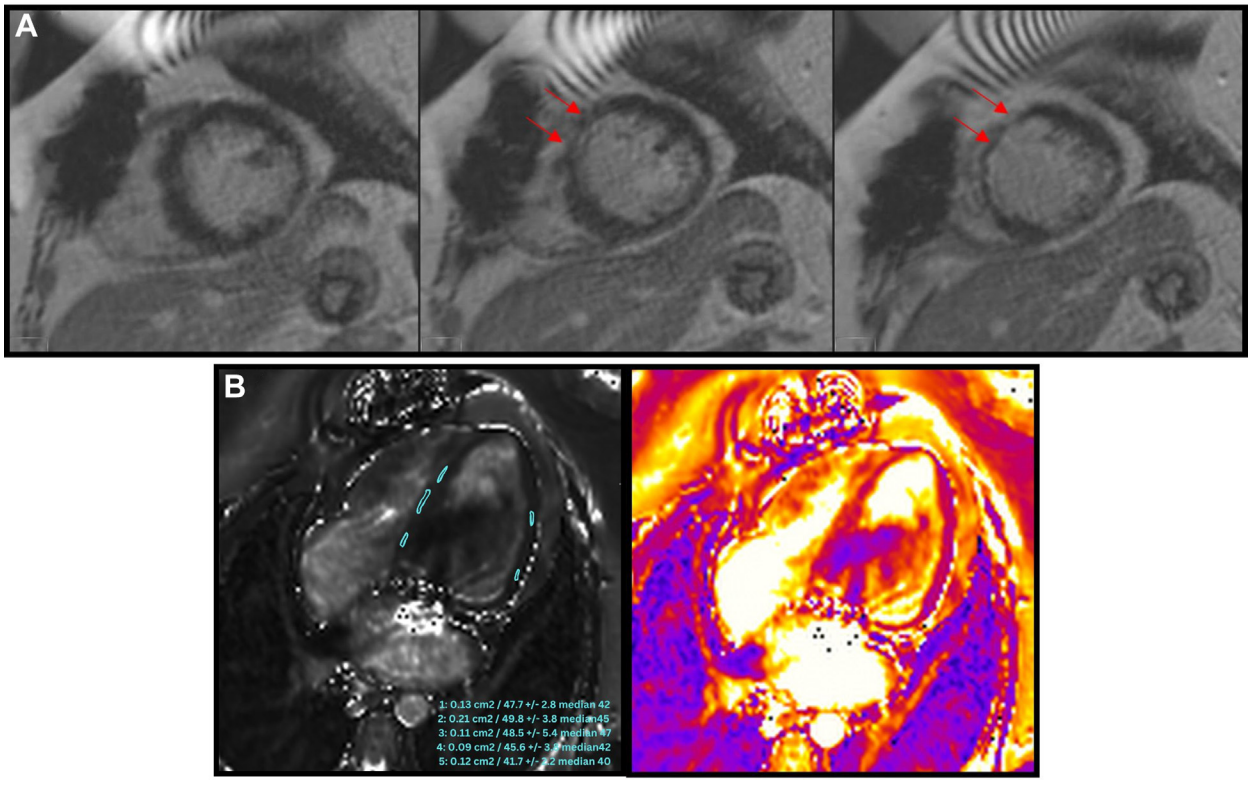
Four months later, the patient experienced recurrence of the symptoms, and a new ^{18}F-FDG PET/CT revealed an inflammatory residual process: slight, diffuse, and heterogeneous FDG uptake in the left ventricle walls with an SUV_{max} of 2.4 (Figure 3). Despite a significant reduction in the intensity of FDG uptake, ^{18}F-FDG PET/CT was still able to detect signs of inflammatory myocardial activity. Thus, an

FIGURE 1 ^{18}F-Fluorodeoxyglucose Positron Emission Tomography Before the First Course of Corticosteroid Therapy



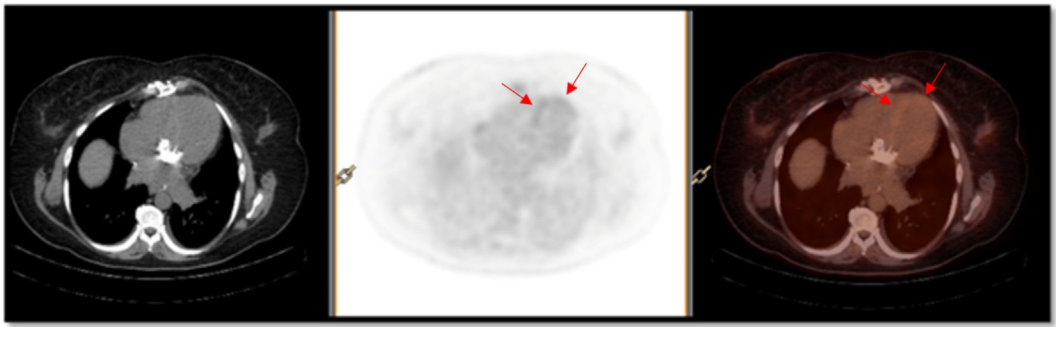
^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography obtained before the first course of corticosteroid therapy with diffusely heterogeneous fluorodeoxyglucose uptake in the left ventricle walls, with a moderate degree (maximum standardized uptake value: 5.4), suggestive for an active inflammatory process.

FIGURE 2 **Cardiac Magnetic Resonance**



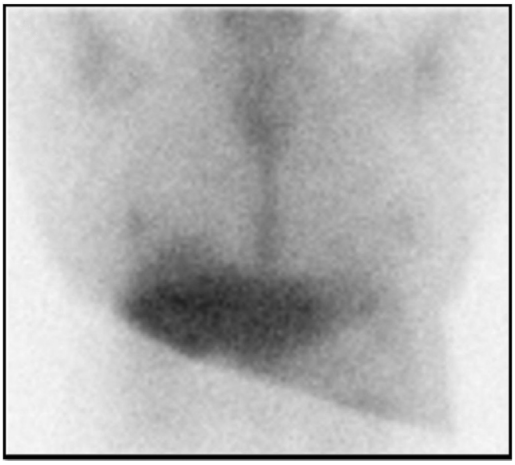
(A) Cardiac magnetic resonance image shows anteroseptal and midapical ischemic pattern of late gadolinium enhancement. (B) Cardiac magnetic resonance image shows a normal transverse relaxation time map across the left ventricle (normal range: <50 ms).

FIGURE 3 **^{18}F-Fluorodeoxyglucose Positron Emission Tomography After Recurrence of Symptoms**



^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography obtained because of worsening of symptoms after the first course of corticosteroid therapy shows diffuse and slightly heterogeneous fluorodeoxyglucose uptake in the left ventricle walls (maximum standardized uptake value: 2.4).

FIGURE 4 Cardiac Scintigraphy After the Second Course of Corticosteroid Therapy



Cardiac scintigraphy obtained after the second course of corticosteroid therapy. The anterior/posterior view of the chest demonstrates an absence of radiopharmaceutical uptake in the projection of cardiac area.

immunosuppressive dose of prednisone (1 mg/kg/day) was reintroduced. After 30 days of treatment, the patient was fully recovered from the symptoms. Benzathine penicillin G was maintained during treatment and afterward for 10 years.

DISCUSSION

Rheumatic fever (RF) is an underdiagnosed and very prevalent disease in low-income countries, responsible for 250,000 deaths in young people worldwide.[3] In Brazil, the incidence rate is around 475 per 100,000 inhabitants.[4] Approximately 20% of RF patients may present reactivation episodes in 10 years, and the diagnosis of RF recurrence is challenging.[5]

RHD is a systemic immune condition that occurs as a complication of acute RF, caused by an abnormal immune response to group A streptococcal infection.[3] The main manifestation of the first acute episode of RC is valvulitis, but myocarditis and pericarditis may also occur.[2] RF reactivation in adults usually causes myocarditis including left ventricular dysfunction and, many times, without severe valvular heart disease.[6,7]

Differential diagnoses of left ventricular dysfunction in these cases include mainly ischemic heart disease, viral myocarditis and cardiac sarcoidosis. MRI is considered the gold standard imaging modality for myocardial tissue characterization, and the elevated transverse relaxation time map is specific for myocardial edema, such as in viral myocarditis. Nevertheless, these findings do not rule out a predominantly interstitial inflammatory process as occurs in RC.[8]

In general, MRI in patients with cardiac sarcoidosis show midmyocardial and subepicardial late gadolinium enhancement that do not follow a coronary artery distribution; however, various other patterns may occur.[9] Usually, ^{18}F-FDG PET/CT shows focal areas of FDG uptake in myocardial walls, and in early stages of cardiac sarcoidosis, it can be observed even without late gadolinium enhancement in MRI. However, no manifestations of extracardiac involvement were detected in this patient, which made cardiac involvement due to sarcoidosis less likely.[2]

There is no definitive diagnostic test for RC, and clinical criteria show high sensitivity and low specificity. Therefore, a diagnosis of RC relies on the exclusion of other prevalent cardiomyopathies.[6] The role of nuclear images in recurrent myocarditis, such as gallium-67 scintigraphy and ^{18}F-FDG-PET/CT, is not well established; however, these image methods have been used to confirm active myocardial inflammation, providing support for this diagnosis in high-probability patients.[6]

In acute RHD, the goal of the treatment is to suppress the inflammatory response using high-dose prednisone (1.0-1.5 mg/kg) for 4 to 6 weeks, followed by a gradual reduction. Reverse cardiac remodeling after corticosteroid treatment reinforces the diagnosis.[6] Although some evidence shoes that secondary prevention may reduce the recurrence of RF by 55%, its impact on RHD is not fully understood.[10] We present a challenging case of reactivated RC and the role of ^{18}F-FDG-PET/CT and gallium-67 scintigraphy as alternative diagnostic tools to evaluate reactivation and the persistence of inflammatory residual process in the follow-up.

FOLLOW-UP

During the clinical follow up, a transthoracic echocardiogram indicated a recovery of the left ventricular ejection fraction to 55%. Additionally, because of the temporary ^{18}F-FDG-PET/CT unavailability, gallium-67 cardiac scintigraphy was performed and showed no signs of myocardial inflammatory process in activity (**Figure 4**). The patient is clinically well, in NYHA functional class I.

CONCLUSIONS

Multimodality image examinations such as ^{18}F-FDG PET/CT, gallium-67 cardiac scintigraphy, magnetic cardiac resonance, and echocardiography are crucial

to diagnose and follow-up patients with RHD suspected to have RF reactivation, especially myocarditis.

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KEY WORDS **cardiac magnetic resonance, positron emission tomography, rheumatic heart disease**