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Case Report

Myocarditis on ^{18}FDG-PET imaging ☆,☆☆,★

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ABSTRACT

Myocarditis is the inflammation of the heart muscle with various clinical presentations and etiology. In this case, we demonstrate the utility of Fluorodeoxyglucose PET scan in identifying its etiology. A 28-year-old female with a history of undifferentiated connective tissue disease and sacroiliitis referred to the cardiology clinic for palpitations. Her symptoms started 3 years ago, were episodic, associated with fatigue, and impaired quality of her life. A resting electrocardiogram revealed sinus tachycardia. Medical workup for sinus tachycardia was unremarkable. Given suspicion for idiopathic myocarditis, a FDG PET using F18 was ordered and revealed diffuse myocardial uptake suggestive of myocarditis. Normal LV systolic function was noted on the echocardiogram. Her tachycardia was successfully treated with ivabradine and diltiazem. She was started on mycophenolate mofetil for myocarditis with improvement in symptoms of tachycardia and fatigue. A repeat FDG PET in follow-up revealed less diffuse uptake with the initiation of therapy. FDG-PET may add value in patients with inappropriate sinus tachycardia found especially if suspicion of underlying connective tissue disease exists. As illustrated in this case, a timely diagnosis could change management decisions as well as significantly impact the quality of life.

Introduction

Myocarditis is the inflammation of the heart muscle. It is a nonspecific process that varies in clinical presentation and etiology. The clinical presentation of this disease can manifest as acute, subacute, or chronic. It is also mediated by infectious or noninfectious etiologies. In this case, we demonstrate the utility of FDG-PET scanners in assessing myocarditis.

Case Report

A 28-year-old female patient with a history of undifferentiated connective tissue disease and sacroiliitis was referred to our cardiology practice for the evaluation of symptomatic sinus tachycardia.

The patient had been experiencing palpitations since the age of 25 with associated fatigue. Her symptoms affected her

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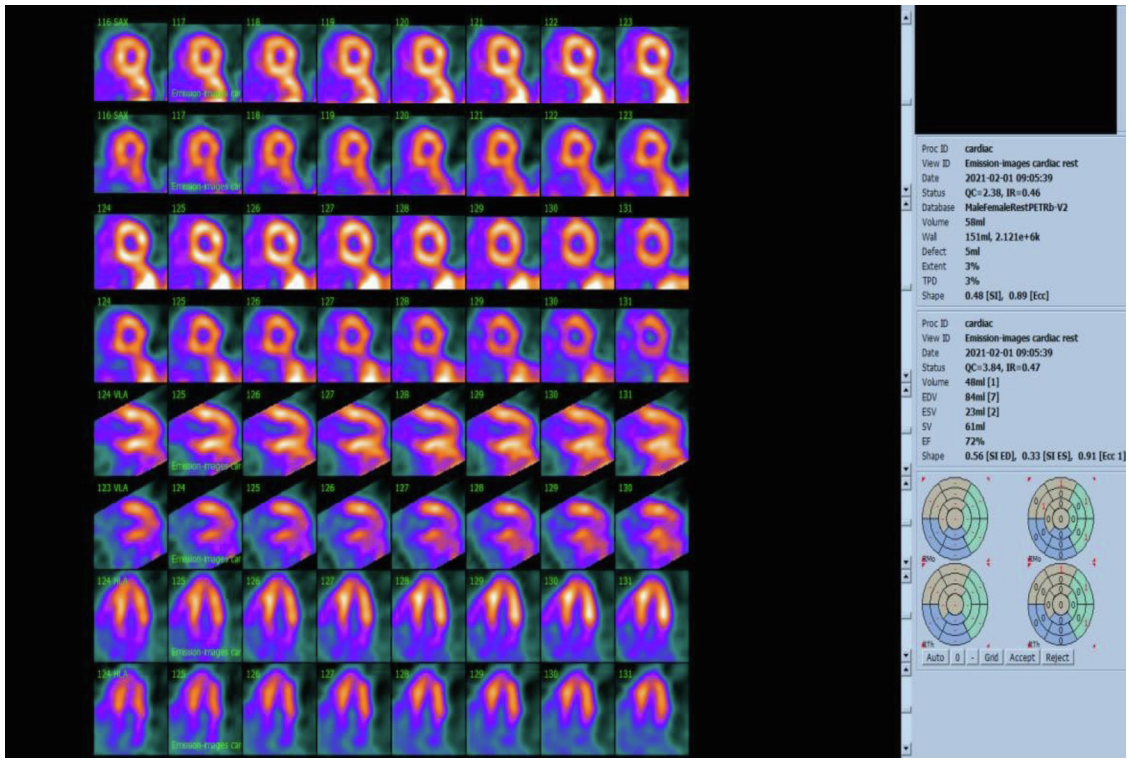

Fig. 1 – 18 F - FDG uptake showing diffuse myocardial uptake suggestive of myocarditis.

quality of life and impaired her ability to exercise. The patient complained of painful fullness in the right sternoclavicular region and trapezius region, associated with mild bilateral lower extremity edema. She denied any swollen joints but had mild peripheral edema. She complained of sporadic low-grade fevers and reported sicca symptoms and paresthesia with no swollen joints.

A Holter monitor revealed sinus tachycardia, with an average heart rate of 100 bpm and a peak of 152 bpm. An electrophysiology study was done which was negative for inducible supraventricular tachycardia. She had a normal Thyroid-stimulating hormone level (TSH). A 2D Echocardiogram revealed normal LV systolic function and wall motion, estimated ejection fraction of 55% to 60%, mild tricuspid regurgitation, and normal right ventricular systolic pressures. Autoimmune serology was unremarkable.

On initial physical examination, blood pressure was 112/80 mmHg with a heart rate (HR) of 100 bpm. Cardiac auscultation showed a 2/6 systolic murmur at the tricuspid area, normal S1S2, and regular rhythm. Lung auscultation was symmetrical, clear bilaterally. Peripheral pulses were intact with trace pedal edema.

Her tachycardia improved with ivabradine and diltiazem. Given suspicion for idiopathic myocarditis a Fluorodeoxyglucose (FDG) PET using F18 was ordered. The patient was infused with 56.0 Rb-82 intravenously in the left antecubital fossa for resting cardiac perfusion 2D, attenuation-corrected PET images. She was then injected with 19.4 mCi of F-18 fluorodeoxyglucose in the left antecubital fossa. The patient rested quietly for 90 minutes before receiving 2D, attenuation-corrected PET imaging of the myocardial F-18 FDG uptake. It showed diffuse myocardial uptake suggestive of myocarditis (Fig. 1).

Thereafter, the patient was referred to a rheumatology specialist. The patient was started on Mycophenolate Mofetil with improved symptoms and a follow-up FDG PET showed improved myocarditis with decreased radiotracer uptake.

Discussion

Viral myocarditis is most common in literature. Important noninfectious causes include giant cell myocarditis (GCM), drug-induced hypersensitivity, and cardiac manifestations of systemic autoimmunity, such as sarcoidosis or systemic lupus erythematosus [1]. Despite extensive research and improved diagnosis and understanding of the pathogenesis of inflammatory cardiomyopathy, this disorder is still associated with a poor prognosis when complicated by left ventricular (LV) dysfunction, heart failure (HF), or arrhythmia [2].

Myocarditis in undifferentiated connective tissue syndromes require high clinical certainty. The term undifferentiated connective tissue disease (UCTD) refers to unclassifiable systemic autoimmune disorders that share clinical and serological manifestations with definite connective tissue diseases (CTDs), such as systemic lupus erythematosus (SLE), systemic sclerosis (SSc), SS, dermatomyositis/polymyositis (DM/PM), mixed connective tissue disease (MCTD), and rheumatoid arthritis (RA), but not fulfilling any of the existing classification criteria [3]. The most common clinical presentation of this disease entity includes arthralgias, arthritis, and

other inflammatory signs. Interestingly, in our case, the patient had nonspecific symptoms such as sicca symptoms and fatigue. This was challenging with regards to diagnosis and emphasized the need for additional sensitive and supportive testing.

Myocarditis has a wide of clinical presentations ranging from chest pain, dyspnea, palpitations, or syncope. In myocarditis presenting as acute or fulminant DCM with heart failure, cardiac troponins are often detectable in blood and can be supportive of the diagnosis [4]. On the other hand, the biomarkers are usually normal with subacute or chronic myocarditis.

Myocarditis requires electrocardiographic and echocardiographic modalities for its diagnosis, although they are neither specific nor sensitive. Cardiac magnetic resonance (CMR) is often more sensitive when compared to Echocardiography. The Lake Louis Criteria (CLL) of cardiac MR is widely used for the diagnosis of myocarditis [5]. On the other hand, FDG-PET has been shown to have high accuracy for the diagnosis of myocarditis [6], when compared to CMR. In healthy myocardium, PET images show normal perfusion and normal ^{18}F-FDG uptake. However, inflamed myocardium shows decreased perfusion and increased ^{18}F-FDG uptake. Activated leukocytes, especially macrophages, are known to express high levels of glucose transporters, which result in rapid accumulation of ^{18}F-FDG at the site of inflammation [7]. The increased metabolic activity is related to a combination of microvascular damage, myocyte damage, and changes in fatty acid metabolism [8].

Nowadays, FDG-PET imaging modality is a noninvasive imaging technique that has showed utility in characterizing myocarditis. Positron emission tomography (PET) performed with fluorine 18 fluorodeoxyglucose (FDG) has the unique ability to depict metabolically active disease, and in this respect, it complements other cross-sectional imaging modalities, which provide predominantly anatomic information [9]. In selected patients with myocarditis, the use of ^{18}F-FDG PET in addition to cardiac MRI might provide complementary information on disease progression [10].

Conclusion

The diagnosis of the cause of myocarditis presents a clinical challenge as there is an overlap between its causes. Early diagnosis and treatment can result in a good clinical result. In fact, FDG-PET may add value in patients with inappropriate sinus tachycardia found especially if suspicion of underlying connective tissue disease exists. As illustrated in this case, a timely diagnosis could change management decisions as well as significantly impact the quality of life.

Patient consent

Informed consent for publication of this case was obtained from the patient.

Learning Objectives

Case: A patient who presented with palpitations secondary to sinus tachycardia.

1. To be able to make a differential diagnosis of sinus tachycardia.
2. To understand the role of FDG-PET in patients with inappropriate sinus tachycardia found especially if suspicion of underlying connective tissue disease exists.

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