CASE REPORT

Undiagnosed cardiac sarcoidosis presenting as complete heart block and ventricular arrhythmia

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Accepted 30 July 2015

SUMMARY

Cardiac involvement in sarcoidosis has been reported to be as high as 50% of cases and it is well documented that it is associated with a poorer prognosis. Early recognition and treatment is key to reducing the risk of fatal arrhythmias and heart failure. We report a case of undiagnosed systemic sarcoidosis in a young man who initially presented to the emergency department with complete heart block in the context of preserved biventricular systolic function, and then again with ventricular tachycardia and moderately impaired left ventricular systolic function. We discuss how 18F-fluorodeoxyglucose positron emission tomography with CT was used for accurate diagnosis and how its role in the management of sarcoidosis has expanded with recent evidence suggesting it to be a mainstay of management and disease monitoring in cardiac sarcoidosis.

BACKGROUND

Sarcoidosis is a well-studied multisystem granulomatous disorder. It remains a rarely diagnosed condition with prevalence estimates ranging from 10.9/100 000 population in Caucasians and 35.5/100 000 in African-Americans.¹ Even though it predominantly affects the lungs, cardiac involvement has been reported as frequently as in 50% of cases of sarcoidosis.² While the aetiology of sarcoidosis remains unclear, the increase in morbidity and mortality associated with cardiac sarcoid is well documented.³ Cardiac sarcoidosis most commonly presents with atrioventricular block³ or tachyarrhythmias, often ventricular in origin.⁴ Independent prognostic indicators for cardiac sarcoidosis include impaired left ventricular (LV) systolic function, New York Heart Association (NYHA) functional class, LV end-diastolic diameter and sustained ventricular tachycardia (VT).⁵

Tissue diagnosis remains difficult due to patchy distribution of active disease and sensitivity is only in the region of 25%.⁶ Thus imaging has an increasingly important role.^{6–7} With transthoracic echocardiogram (TTE) not being useful in early disease detection, cardiac MRI (CMR) is considered the first-line imaging modality for evaluation of cardiac sarcoidosis due to its high spatial and accurate tissue resolution of the myocardium,⁸ and high sensitivities and specificities.^{8–9} However, improved protocols have led to an increase in the use of 18F-fluorodeoxyglucose positron emission tomography with CT (18F-FDG PET-CT) for diagnosis in cases where CMR is contraindicated, as it has demonstrated equal sensitivities to CMR (9). It

has also been used as a guide to use of immunotherapy.¹⁰

We present a case of histologically confirmed diagnosis of systematic sarcoidosis with cardiac involvement in a patient who presented with complete heart block (CHB) and VT on separate occasions, along with biventricular systolic impairment. We also discuss the role of 18F-FDG PET-CT in cardiac sarcoidosis, particularly in relation to this case.

CASE PRESENTATION

A 49-year-old Afro-Caribbean man presented to his general practitioner with a 1-week history of dizziness. He had a history of hypertension, for which he took amlodipine, but was otherwise fit and well. He had no family history of note and was a non-smoker. On examination, he was noted to be bradycardic with a heart rate of around 30–40 bpm. He was promptly referred to accident and emergency (A&E). A consequent ECG in A&E showed CHB. His investigations including blood test and chest radiograph were unremarkable except for mildly raised creatinine of 123 µmol/L. The TTE demonstrated normal biventricular size and systolic function. He had a permanent dual-chamber pacemaker (PPM) implanted successfully and the remainder of his hospital stay was uneventful. Further follow-up in pacing clinic demonstrated that the device was functioning well and that the patient remained clinically asymptomatic.

Eighteen months later, the patient presented to A&E with a very short history of dizziness and shortness of breath. Following triage by nursing staff, he lost consciousness. On assessment, it was noted that he was in pulseless VT and cardiopulmonary resuscitation was initiated. He was successfully shocked at 150 J back into sinus rhythm, and regained cardiac output. He successfully regained consciousness and did not require invasive support. Examination was again unremarkable and interrogation of the PPM revealed an isolated episode of 15 min of VT.

Investigations this time revealed worsening renal function with creatinine of 171. The repeat TTE showed moderately impaired LV systolic function with a visually estimated ejection fraction (EF) of 40–45% secondary to inferolateral and inferior wall hypokinesia. The right ventricle was also dilated, with impaired systolic function. In the context of raised troponin, regional wall motion abnormality on TTE and presentation with VT, the patient underwent a diagnostic coronary angiogram demonstrating unobstructed coronary arteries.

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To cite: Mcbeath K, Honarbakhsh S, Chowdhury M, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-211736

Figure 1 18F-fluorodeoxyglucose positron emission tomography with CT images. (A and B) Increased uptake in left ventricular wall in a non-perivascular distribution. (B and C) Increased uptake in multiple organs (B: liver and spleen; C: lungs, predominantly right hilar region).

Having presented with ventricular arrhythmia and impaired biventricular systolic function, assessment for an underlying cardiomyopathy was warranted. The aim was to better characterise the myocardium to identify both a cause for the impaired function and any scar or fibrosis that could have triggered VT. The presentation of CHB followed by VT suggested a diagnosis of cardiac sarcoidosis. Even though CMR is an excellent imaging tool for the diagnosis of sarcoidosis, it was not feasible in our patient due to the MR-incompatible device in situ. As 18F-FDG PET-CT has demonstrated equal sensitivities to CMR in the diagnosis of cardiac sarcoidosis, it was used as an alternative.

The 18F-FDG PET-CT demonstrated increased metabolic activity in the myocardium, especially in the inferolateral wall, and in a non-perivascular distribution (figure 1A, B). It further showed increased uptake in the liver, spleen, kidney, hila and apices of the lungs (figure 1B, C). The history and distribution of uptake were highly suggestive of disseminated sarcoidosis. However, in order to confirm diagnosis, the liver was identified on 18F-FDG PET-CT as an appropriate target for biopsy and subsequent liver biopsy histologically confirmed sarcoidosis.

OUTCOME AND FOLLOW-UP

In view of the presentation with pulseless VT, the patient met the criteria for implantable cardioverter defibrillator (ICD) implantation for secondary prevention. As he was pacing dependent he was at risk of further deterioration in his LV function and so the dual-chamber pacemaker was successfully upgraded to a cardiac resynchronisation device with defibrillator lead (cardiac resynchronisation therapy defibrillators; CRT-D). He was started on prednisolone and methotrexate. At 6 months follow-up, his LV systolic function remained stable and he had not had any further episodes of haemodynamically compromising VT.

DISCUSSION

Presentation of sarcoidosis correlates closely with its predilection for the interventricular septum and areas of dense myocardium (most commonly LV free wall), causing conduction abnormalities and a progressive infiltrative cardiomyopathy,³ which was the case in our patient, who presented with CHB and VT, as well as biventricular systolic impairment. It should therefore be strongly considered in patients under 55 years of age who present with high-degree atrioventricular block or ventricular arrhythmias. With such risk of fatal arrhythmia, the need for early and accurate detection is clear, only compounded by Japanese data showing sudden cardiac death to be the presentation in 40% of cardiac sarcoidosis patients.⁴

18F-FDG PET-CT relies on the increased glucose metabolism in inflammatory cells, with 18F-FDG avidly taken up through overexpressed glucose transporters.¹¹ Thus highly metabolically active areas of tissue will be radio-bright. It is combined with

standard CT in order to provide accurate anatomical comparison. Meta-analysis of PET-CT imaging has shown a pooled sensitivity and specificity of 89% and 78%, respectively, percentages that are comparable to MRI² and replicated in early stages of disease.¹² Beyond its role in detection of disease, 18F-FDG PET-CT shows superiority to MRI as a tool to guide therapy, as it is able to assess disease activity.¹⁰ This aids decision to initiate immunosuppressive therapy as levels of disease activity on imaging correlate with risk of VT and sudden cardiac death.¹³ It also allows monitoring of response to current therapy, and a reduction in the intensity and extent of inflammation on 18F-FDG PET-CT imaging is associated with an improvement in EF.¹⁴ In addition, it does not suffer the same contraindications as CMR to MR-incompatible devices and patients with chronic kidney disease unable to tolerate gadolinium contrast. In our patient, the use of 18F-FDG PET-CT enabled us to not only diagnose active systematic sarcoidosis with cardiac involvement, but to identify the liver as a suitable biopsy site to obtain a histological diagnosis, as well. The activity on the imaging also emphasised the need to suppress the immune response, and thereby the patient was started on high-dose steroids and immunosuppression with methotrexate. Further to this, prevention of fatal arrhythmias through implantation of a cardiac device, that is an ICD, is key. As our patient was pacing dependent with LV impairment, his device was upgraded to a CRT-D.

18 F-FDG PET-CT imaging is a sensitive imaging modality for the early detection of active cardiac sarcoidosis in all patients. With the increased burden of pacemakers in the population and new data suggesting it provides prognostic information as well as aiding disease monitoring, PET continues to gain support in the diagnosis and management of cardiac sarcoidosis.

Learning points

- ▶ Complete heart block in a patient under the age of 55 years requires further evaluation and consideration of cardiac sarcoidosis.
- ▶ Positron emission tomography with CT is useful because:
 - It provides cardiac MRI (CMR) comparable rates of detection of both cardiac and extracardiac sarcoidosis.
 - Levels of imaging activity correlate with disease activity, risk of ventricular tachycardia and sudden death. Thus it prompts initiation of immunomodulatory therapy and allows monitoring of response.
 - It provides a target for image-guided biopsy.
 - It provides an alternative imaging modality in those with contraindications to CMR.

Contributors All the authors were actively involved in the management of the patient. KM and SH wrote the first draft and the remaining drafts. MC and FF provided constructive feedback and contributed to writing the subsequent drafts of the case report.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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