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Rapid communication

## Bidirectional ventricular tachycardia in cardiac sarcoidosis<sup>☆</sup>

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### ABSTRACT

A 73-year-old man with history of pulmonary sarcoidosis was found to have runs of non-sustained bidirectional ventricular tachycardia (BVT) with two different QRS morphologies on a Holter monitor. Cardiac magnetic resonance delayed gadolinium imaging revealed a region of patchy mid-myocardial enhancement within the left ventricular basal inferolateral myocardium. An 18-fluorodeoxyglucose positron emission tomography (FDG-PET) showed increased uptake in the same area, consistent with active sarcoid, with no septal involvement. Follow-up FDG-PET one year later showed disease progression with new septal involvement. Cardiac sarcoidosis, characterized by myocardial inflammation and interstitial fibrosis that can lead to conduction system disturbance and macro re-entrant arrhythmias, should be considered in differential diagnosis of BVT. BVT may indicate septal involvement with sarcoidosis before the lesions are large enough to be detected radiologically.

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## 1. Introduction

Bidirectional ventricular tachycardia (BVT) is defined as a tachycardia showing beat-to-beat alternation in the QRS axis. The rate is typically between 140 and 180 bpm, with a frontal plane axis varying between  $-20^\circ$  and  $110^\circ$ . The most common causes of BVT include catecholaminergic polymorphic ventricular tachycardia and cardiac glycoside toxicity. Other previously described etiologies include myocarditis, long QT syndrome type 7, congenital cardiomyopathies, cardiac tumors, and acute cardiac allograft rejection. Cardiac sarcoidosis is characterized by myocardial inflammation and interstitial fibrosis that can lead to slowed conduction and macro re-entrant arrhythmias. We report a case of

BVT in a patient with cardiac sarcoidosis and briefly discuss the proposed mechanisms underlying BVT.

## 2. Case

A 73-year-old man with history of chronic pulmonary sarcoidosis was seen for an annual checkup, during which ventricular bigeminy was identified on a 12-lead electrocardiogram. Subsequent Holter monitor assessment showed multiple premature ventricular beats and several short runs of non-sustained ventricular tachycardia (VT), with two different QRS morphologies (Fig. 1). A cardiac magnetic resonance tomography with delayed gadolinium showed a curvilinear region of patchy mid-myocardial enhancement within the inferolateral left ventricular myocardium near the base, consistent with cardiac sarcoidosis (Fig. 2). The left and right ventricular ejection fractions were 47% and 37%, respectively. A nuclear myocardial perfusion study using single-photon emission computed tomography showed no myocardial perfusion defects on stress or rest imaging, ruling out ischemia. A fasting 18-fluorodeoxyglucose positron emission tomography (PET) demonstrated increased uptake in the same area of the myocardium that had shown late gadolinium enhancement, consistent with active cardiac sarcoid (Fig. 3A). A one-year follow-up PET showed disease progression, with new septal involvement

**Abbreviations:** BVT, Bidirectional ventricular tachycardia; ICD, Implantable cardioverter defibrillator; PET, Positron emission tomography; PVC, Premature ventricular contraction; VT, Ventricular tachycardia.

<sup>☆</sup>N. B. The patient was treated at the University of Wisconsin Hospital. Dr Scheinman was consulted as an expert in the field and has reviewed and modified the submission.

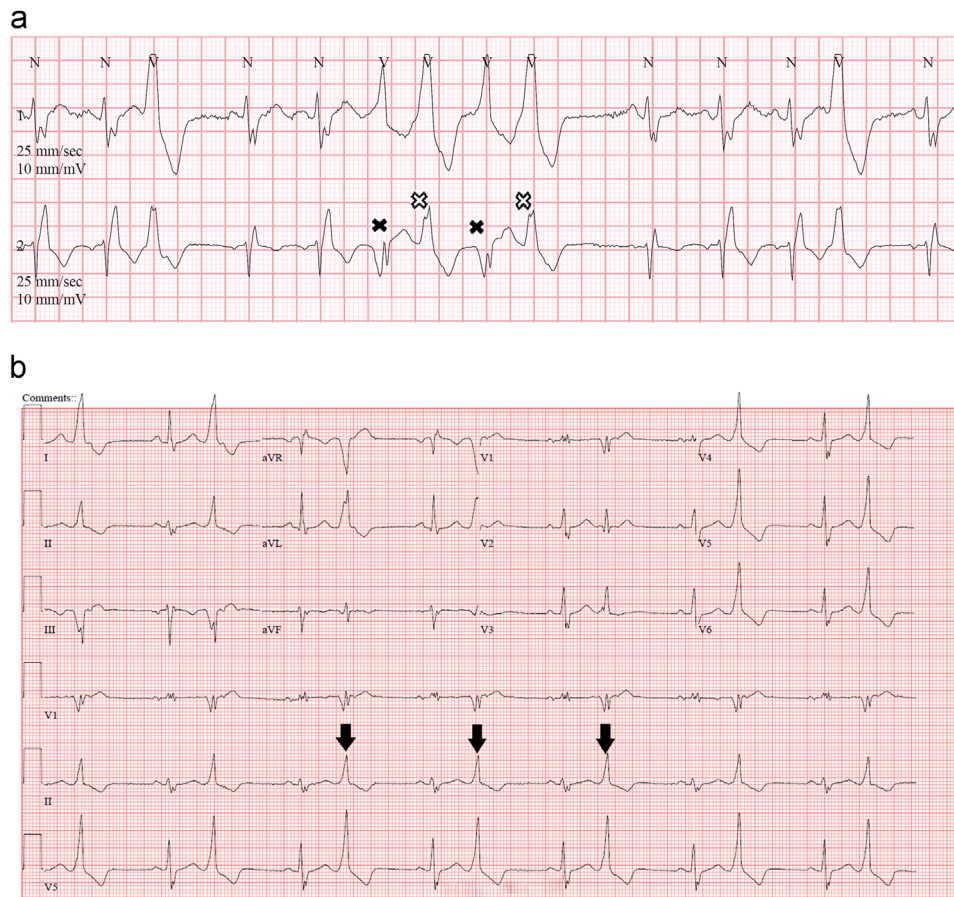
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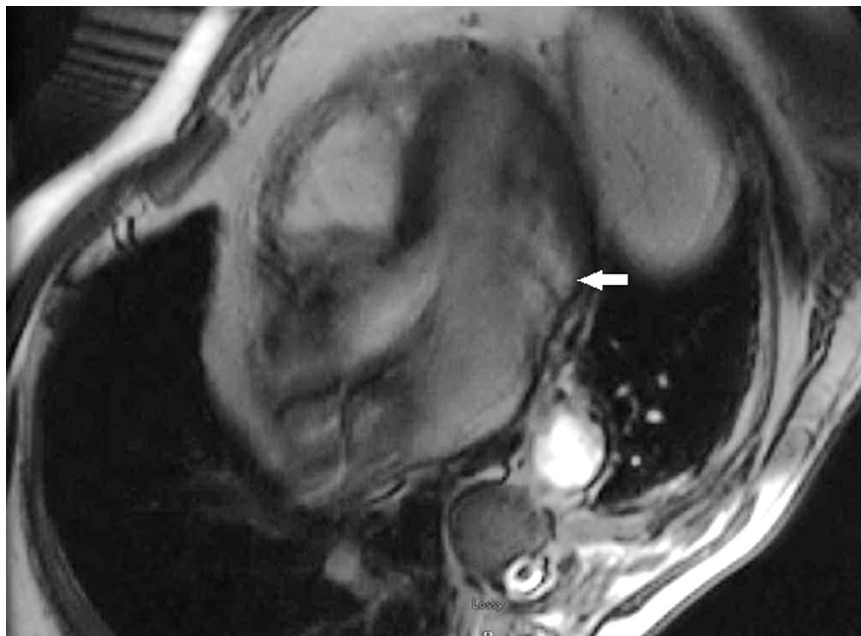
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**Fig. 1.** (A) Rhythm strip with leads II and V (nonspecific ventricular), top and bottom, respectively, showing sinus rhythm and a run of ectopic ventricular beats with two alternating QRS morphologies; the sixth and eighth beats show a left bundle branch block morphology and inferior axis (black X), while the seventh and ninth show a right bundle branch block morphology and inferior axis (white X). This pattern was seen repeatedly on ambulatory monitoring. Note that the degree of the right bundle branch block increases during sinus rhythm; the QRS width in the fourth beat is about 120 ms, compared to approximately 160 ms in the fifth beat. A similar phenomenon is also seen between the tenth and eleventh beats even during a relatively long atrial cycle length of 600 ms. This suggests severe impairment of the conduction system. (B) A 12-lead electrocardiogram showing sinus rhythm with intraventricular conduction delay, with PVCs in a pattern of ventricular bigeminy. The PVCs resembles a left bundle branch block pattern with an inferior axis (arrows).



**Fig. 2.** Delayed enhancement cardiac magnetic resonance tomography with patchy mid-myocardial enhancement in the basal inferolateral left ventricular myocardium (arrow).

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