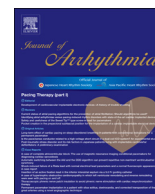




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Case Report

A case of complete atrioventricular block: The use of magnetic resonance imaging conditional pacemakers for diagnosing cardiac sarcoidosis



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ABSTRACT

A 50-year-old man presented to the emergency department with repeated episodes of faintness and exertional dyspnea, and was found to have an atrioventricular (AV) block. Chest radiography and transthoracic echocardiography results were normal, without any evidence of heart failure, wall motion abnormalities, interventricular septum thinning, or bilateral hilar lymphadenopathy. A temporary pacemaker was implanted, followed by a permanent pacemaker. Chest computed tomography with contrast enhancement did not show abnormalities, including patent coronary arteries, lymph node adenopathy, and pulmonary abnormalities. Thus, an MRI conditional dual chamber pacemaker and leads were implanted. Six weeks following the implant, a cardiac MRI was performed to test for cardiac sarcoidosis. Although cine imaging showed normal left and right ventricular function, late gadolinium enhancement demonstrated multiple enhanced uptakes. Based on the results of the cardiac MRI, PET, and gallium scintigraphy, the most likely diagnosis was cardiac sarcoidosis. Although no abnormal findings were found on physical examination, blood work, chest radiography, and transthoracic echocardiogram, multiple regions of delayed enhancement were observed in the cardiac MRI. Thus, MRI conditional pacemakers are a useful tool for diagnosing cardiac sarcoidosis and early therapeutic intervention.

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1. Introduction

Cardiac sarcoidosis is a known cause of atrioventricular (AV) block, especially in younger people. Its progression can lead to ventricular tachycardia or heart failure [1]. Steroid therapy or immune suppressive therapy is moderately effective in the treatment of cardiac sarcoidosis [2,3], provided it is diagnosed early.

Cardiac MRI is an important diagnostic tool for cardiac sarcoidosis [4]. However, until recently, since MRI conditional pacemakers and ICDs were approved for use, the use of MRI was contraindicated in patients with implanted devices [5,6].

Here we present a case of a patient who presented with a complete AV block and underwent MRI conditional pacemaker implantation. A subsequent cardiac MRI suggested a likely diagnosis of cardiac sarcoidosis.

2. Case report

A 50-year-old man presented to the emergency department with repeated episodes of fainting and exertional dyspnea for 10 days, and was found to have an AV block. Chest radiography and transthoracic echocardiography results were normal, without any evidence of heart failure, wall motion abnormalities, interventricular septum thinning, or bilateral hilar lymphadenopathy. A temporary pacemaker was implanted, followed by a permanent pacemaker. Subsequent chest computed tomography (CT) with contrast enhancement did not show any abnormalities, including patent coronary arteries, lymph node adenopathy, and pulmonary abnormalities. An MRI conditional dual chamber pacemaker and leads (Advisa DR MRI™ SureScan™ with 5086 leads; Medtronic, Minneapolis, USA) were thereafter implanted (Fig. 1). Six weeks following the implant, a cardiac MRI was performed to test for cardiac sarcoidosis. Although cine imaging showed normal left and right ventricular function, late gadolinium enhancement demonstrated multiple enhanced uptakes (Fig. 2). Gallium scintigraphy revealed multiple uptakes in the heart, along with axillary and inguinal lymph nodes (Fig. 3). A PET-CT of the heart demonstrated

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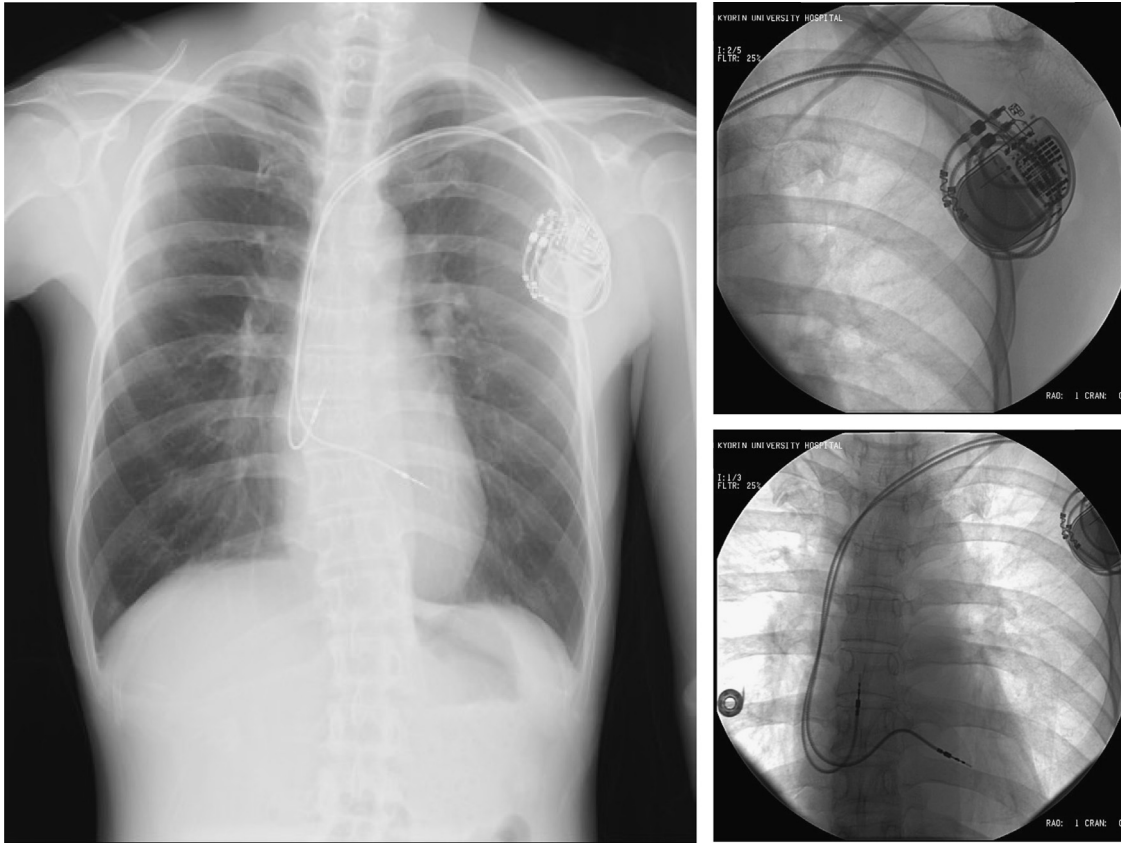


Fig. 1. Chest radiography following MRI conditional pacemaker implantation. No abnormal findings are seen in the lungs.

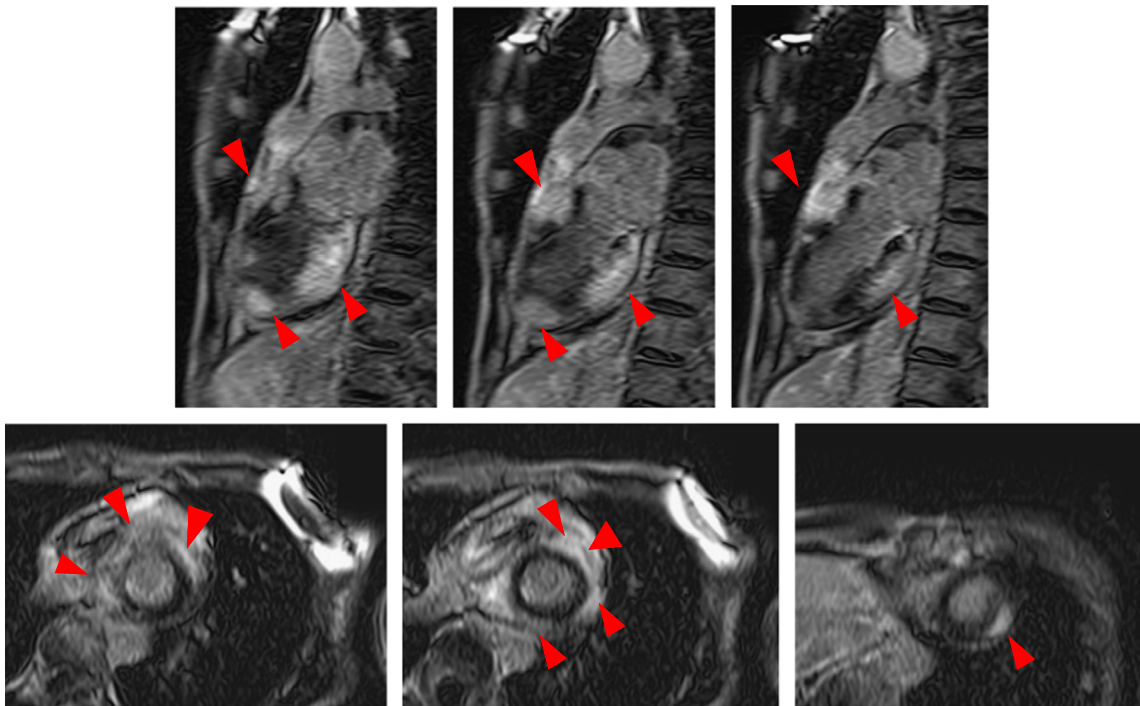


Fig. 2. Cardiac MRI with gadolinium enhancement. Left and right ventricular function is normal, but multiple areas with delayed enhancement are observed in the basal anteroseptal, lateral, and apical regions (shown by red arrows).

multiple enhanced uptakes appearing on the interventricular septum and left ventricular free wall (Fig. 4).

The serum levels of the angiotensin-converting enzyme, lysozyme, and other laboratory parameters were within normal range.

We were unable to obtain consent for the endocardial or lymph node biopsy, but considering the results of the cardiac MRI, PET, and gallium scintigraphy, the most likely diagnosis was cardiac sarcoidosis.

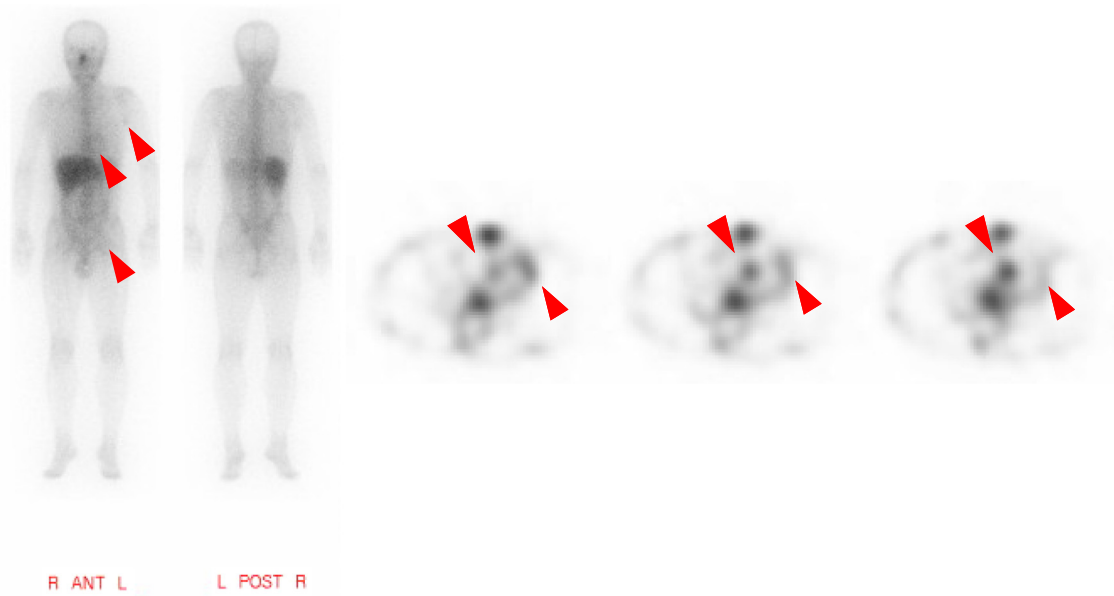


Fig. 3. Gallium scintigraphy where multiple uptakes in the heart as well as the inguinal and axillary lymph nodes are visible.

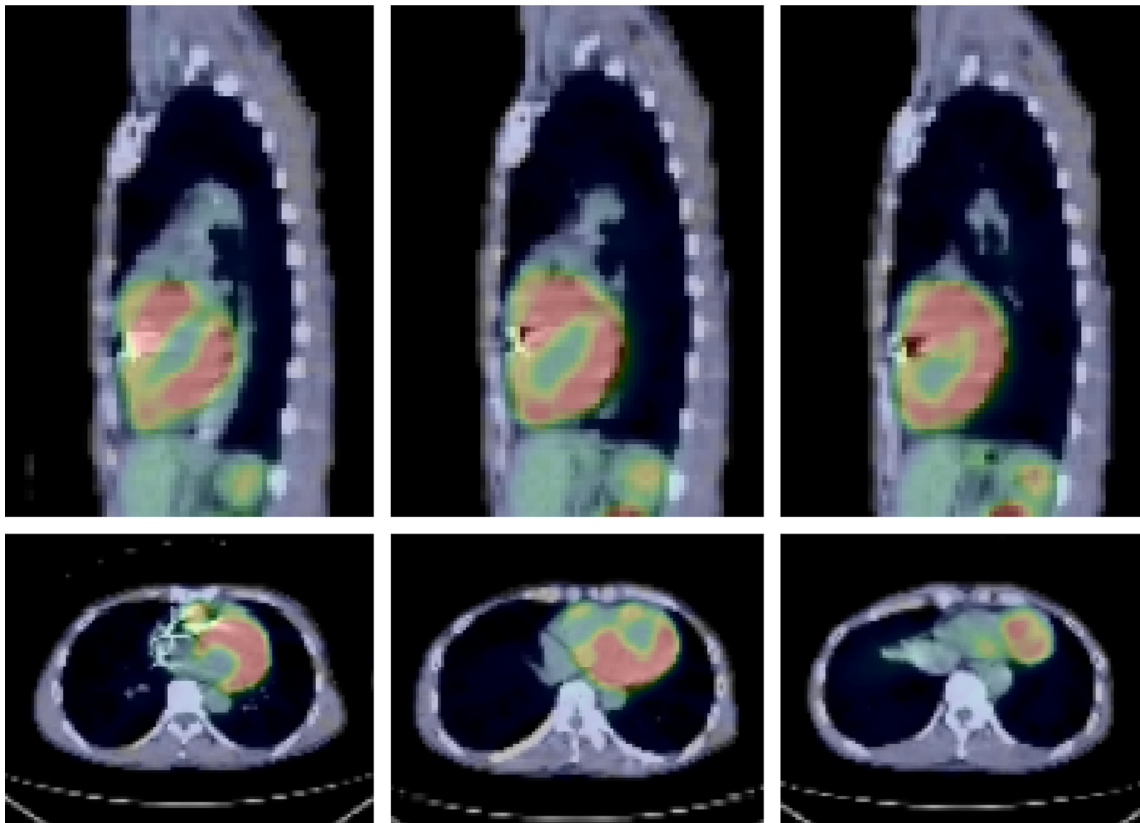


Fig. 4. Cardiac PET-CT with multiple uptakes, similar to the enhancement on the MRI with gadolinium. Colored bars indicate the range of the photon energies for PET. The red color represents high intensity of metabolic activity throughout the heart.

3. Discussion

Cardiac MRI with gadolinium enhancement has been established as a powerful tool for detecting cardiac diseases. However, until recently, the use of MRI was contraindicated in patients with implanted devices. In patients with complete AV block, a temporary pacemaker is usually required, which eliminates the need for cardiac MRI prior to implantation of the permanent pacemaker. Recently, MRI conditional pacemakers and ICDs have been introduced and are

available clinically. In our patient with complete AV block, an MRI conditional pacemaker was implanted following insertion of a temporary pacemaker. Six weeks after the implantation, the patient underwent a cardiac MRI, which revealed delayed enhancement at multiple sites, including the AV-node region.

MRI can induce several hazardous effects, including device inhibition, rapid pacing, mechanical torque and rotation of the device, device failure, resetting, and lead heating. Therefore, the components in MRI conditional devices have been redesigned to

minimize the energy induced and discharged due to static, gradient, and combined field effects. This includes protecting the power supply circuit, changing the lead design to minimize and attenuate any radiofrequency energy discharges at the tip, changing firmware to provide MRI conditional protection, and changing from a reed-switch to a Hall sensor [7]. Moreover, a specific MRI conditional mode was created to ensure appropriate device operation and pacing therapy. Owing to these changes, MRI conditional devices were deemed clinically safe for use [8].

In relatively younger patients who present with AV block, cardiac sarcoidosis should be considered a differential diagnosis [9]. Steroid or immunosuppressive therapy should be initiated if the disease is in the active stage [10]. During the chronic phase of cardiac sarcoidosis, cardiac MRI is useful for evaluating disease progression or scar characteristics of the substrate of a ventricular arrhythmia [11].

In our current patient, although no abnormal findings were found in the physical examination, blood work, chest radiography, and transthoracic echocardiogram, cardiac MRI showed multiple regions of delayed enhancement. Thus, MRI conditional pacemakers are valuable as an early therapeutic intervention.

4. Conclusions

MRI conditional pacemakers are a powerful and useful tool for the diagnosis and management of patients with cardiac sarcoidosis complicated with AV block.

Conflict of interest

None of the authors have any conflict of interest to disclose.

References

- [1] Iannuzzi MC, Rybicki BA, Teirstein AS. Sarcoidosis. *N Engl J Med* 2007;357:2153–65.
- [2] Takada K, Ina Y, Yamamoto M, et al. Clinical evaluation of corticosteroid therapy. *Sarcoidosis* 1994;11:113.
- [3] Yazaki Y, Isobe M, Hiroe M, et al. Central Japan Heart Study Group. Prognostic determinants of long-term survival in Japanese patients with cardiac sarcoidosis treated with prednisone. *Am J Cardiol* 2001;88:1006.
- [4] Smedema JP, Snoep G, van Kroonenburgh MP, et al. Evaluation of the accuracy of gadolinium-enhanced cardiovascular magnetic resonance in the diagnosis of cardiac sarcoidosis. *J Am Coll Cardiol* 2005;45:1683–90.
- [5] Hayes DL, Holmes Jr DR, Gray JE. Effect of 1.5 T nuclear magnetic resonance imaging scanner on implanted permanent pacemakers. *J Am Coll Cardiol* 1987;10:782–6.
- [6] Santini L, Forleo GB, Santini M. Implantable devices in the electromagnetic environment. *J Arrhythmia* 2013;29:325–33.
- [7] Sutton R, Kanal E, Wilkoff BL, et al. Safety of magnetic resonance imaging of patients with a new Medtronic EnRhythm MRI Sure Scan pacing system: clinical study design. *Trials* 2008;9:68.
- [8] Wilkoff BL, Bello D, Taborsky M, et al. EnRhythm MRI SureScan Pacing System Study Investigators. Magnetic resonance imaging in patients with a pacemaker system designed for the magnetic resonance environment. *Heart Rhythm* 2011;8:65–73.
- [9] Yoshida Y, Morimoto S, Hiramitsu S, et al. Incidence of cardiac sarcoidosis in Japanese patients with high-degree atrioventricular block. *Am Heart J* 1997;134:382–6.
- [10] Takada K, Ina Y, Yamamoto M, et al. Prognosis after pacemaker implantation in cardiac sarcoidosis in Japan. Clinical evaluation of corticosteroid therapy. *Sarcoidosis* 1994;11:113–7.
- [11] Bando M, Soeki T, Niki T, et al. Ventricular tachycardia in cardiac sarcoidosis controlled by radiofrequency catheter ablation. *Int Med* 2011;50:1201–6.