Ventricular tachycardia in iron man

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Introduction

Iron-overload cardiomyopathy is a rare condition that is associated with ventricular arrhythmias. The appropriate management of patients presenting with iron-overload cardiomyopathy and ventricular tachycardia often has to be individualized. We present a case of a young man presenting with life-threatening ventricular tachycardia as a result of iron-overload cardiomyopathy and discuss the management of the case.

Case report

A 25-year-old male patient presented with acute onset of chest pain and dizziness. He was found to have hemodynamically compromising refractory ventricular tachycardia (Figure 1), which necessitated more than 10 episodes of cardioversion with intravenous lignocaine before the tachyarrhythmia ceased.

The patient has a history of beta thalassemia major that has required regular blood transfusions as well as concomitant self-administered subcutaneous chelation therapy with deferoxamine with deferiprone for the past 5 years. However, he had been noncompliant with his chelation therapy.

Serum ferritin concentrations were 3083 μg/L (normal range: 24–336 μg/L). The cardiac magnetic resonance images showed the left ventricle (LV) to be mildly dilated but with normal ejection fraction. The LV myocardium appeared diffusely dark in the steady-state free precession (SSFP) sequences (Figure 2) with a T2* time of 3.2 milliseconds (normal: >20 milliseconds), which is consistent with severe myocardial iron deposition. This phenomenon was at a level that placed him at high risk for cardiac decompensation and arrhythmias. Dark signal intensity of the liver was also noted, with a T2* value of 1.4 milliseconds, which is consistent with severe liver iron loading (Figure 2). The right ventricle systolic function and morphology were normal, with no demonstrable aneurysmal, akinetic, or dyskinetic segments to suggest a right ventricular cardiomyopathy.

Aggressive intravenous chelation therapy was started. In view of the refractory nature of the ventricular tachycardia, the option of implantable cardioverter-defibrillator (ICD) was explored and accepted, and a device was subsequently implanted, after which the patient was discharged well. Three months post discharge, while undergoing iron chelation therapy, ICD interrogation revealed that he had suffered several episodes of recurrent ventricular tachycardia, which were successfully cardioverted by the ICD. Serum ferritin concentrations had by then come down to 1247 μg/L. One year post ICD implantation, a repeat cardiac magnetic resonance imaging study was performed. The repeat study showed persistent severe myocardial iron loading with a myocardial T2* value of 3.6 milliseconds. His liver iron loading, however, had significantly improved to 3.6 milliseconds. Serum ferritin levels had come down further, to 692 μg/L.

Discussion

The incidence of iron-overload cardiomyopathy in thalassemia major ranges from 11.4% to 15.1%.[1,2] Significant myocardial iron loading is associated with an increased risk of developing cardiac arrhythmias, yet review of the literature suggests that ventricular arrhythmias account for only a small proportion of all arrhythmias in this condition.[3]

Current guidelines[4] do not specify the use of an ICD for the primary or secondary prevention of sudden cardiac death in a potentially reversible condition such as iron-overload cardiomyopathy. Iron chelation therapy significantly reduces myocardial iron content and reverses iron-overload cardiomyopathy.[5] This phenomenon suggests that an ICD insertion may not be immediately indicated or required in secondary prevention. The primary objective of management in secondary prevention of malignant arrhythmias in such cases may therefore potentially be limited to the prescription of antiarrhythmic medications to prevent recurrent episodes in the short to medium term with concurrent intensive iron chelation to achieve rapid myocardial iron off-loading.

Published data, however, imply that iron clearance from myocardium is very slow, with a half-life of 13–14 months (4 times that of liver clearance), even with intravenous

KEYWORDS Iron-overload cardiomyopathy; Implantable cardioverter-defibrillator; Ventricular tachycardia

ABBREVIATIONS ICD = implantable cardioverter-defibrillator; **LV** = left ventricle; **MRI** = magnetic resonance imaging; **SSFP** = steady-state free precession (Heart Rhythm Case Reports 2016;2:98–100)

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KEY TEACHING POINTS

- Iron-overload cardiomyopathy is an uncommon cause of cardiomyopathy that is associated with increased risk of cardiac arrhythmias.
- The main aim of iron chelation therapy is to decrease the amount of iron deposition in the myocardium as well as other organs, such as the liver.
- The effectiveness of chelation therapy to reduce the incidence of arrhythmias associated with iron-overload cardiomyopathy is presently unclear.
- The use of an implantable cardioverter-defibrillator may be considered for patients presenting with ventricular tachyarrhythmias.

chelation.[6] Thus, a management dilemma regarding the exact timing of ICD implantation, if any, seems to arise. One would struggle with the benefit of preventing sudden cardiac death afforded by an early ICD implantation versus waiting for significant myocardial iron off-loading to take place, to reduce the risk of further arrhythmia recurrence. In this patient, 3 months post ICD insertion, despite ferritin levels decreasing to one-third of the value observed on the first presentation, parallel ICD interrogation demonstrated the recurrence of sustained ventricular tachycardia, which was successfully terminated with cardioversion. This occurrence could have been potentially fatal if the patient had not had an ICD implanted during the index hospitalization.

Myocardial iron loading may be present independent of a matched degree of hepatic hemosiderosis or, conversely, may be spared despite significant loading of other organs.[7] Serum iron and ferritin content or estimation of liver iron content by biopsy has therefore limited ability to predict myocardial iron content. Monitoring myocardial iron overload during iron chelation therapy is not feasible by repeated myocardial biopsy, because of the spatial and temporal heterogeneity of iron distribution and the inherent risk of complications with this procedure.

Magnetic resonance imaging T2* is now widely used for the quantification of myocardial iron. Data from studies using myocardial biopsy have shown that cardiac T2* relaxation times are in strong agreement with myocardial iron content quantified by myocardial biopsy.[8,9] Additionally, serum ferritin concentrations also do not correlate with myocardial T2* values.[10]

Magnetic resonance imaging T2* is an ideal noninvasive tool for the monitoring of myocardial iron content as well as LV function during iron chelation therapy. Longitudinal data suggest that both myocardial T2* times and LV function improve in parallel, in response to intensive chelation therapy.[6] It is uncertain whether the incidence and prevalence of arrhythmias resulting from iron load cardiomyopathy will decrease with the improvement in myocardial T2* times or LV function. Studies have shown that 83% of patients with iron-overload cardiomyopathy and arrhythmias had myocardial T2* times of <20 milliseconds.[3] The threshold T2* value beyond which arrhythmias cease to be a concern has yet to be determined, but it most likely overlaps with normal values. A value above 20 milliseconds is generally considered to be normal, and this value seems to be a reasonable goal to work toward to significantly reduce the possibility of arrhythmia occurrence.

The paucity of clinical trials addressing the most appropriate management for ventricular arrhythmias in iron-overload cardiomyopathy implies that the consideration for an ICD implant must take an individualized approach. Iron-overload cardiomyopathy patients who present with life-threatening ventricular arrhythmias therefore may be suitable candidates for ICD implantation for the prevention of sudden cardiac death while they wait for appropriate iron chelation therapy to take its ameliorating effect on arrhythmias, if any occur.

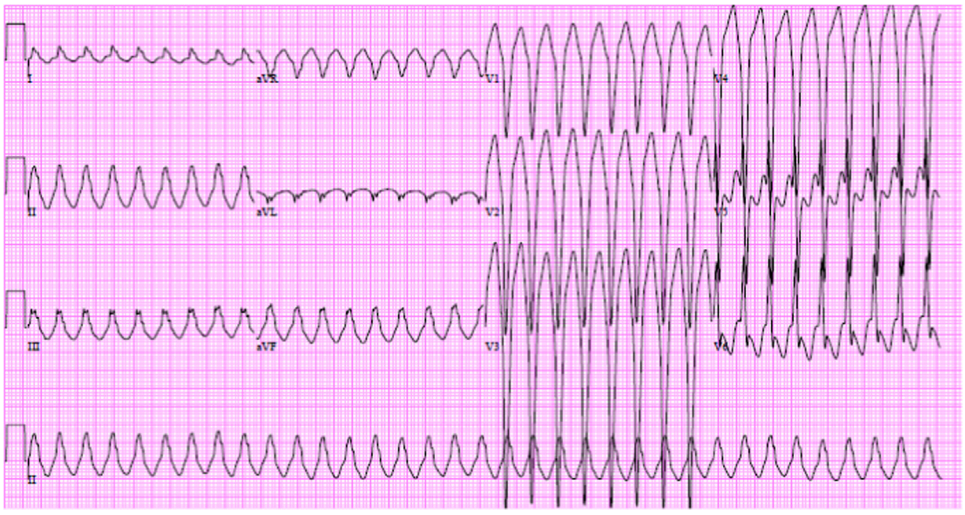

Figure 1 Monomorphic ventricular tachycardia on presentation.

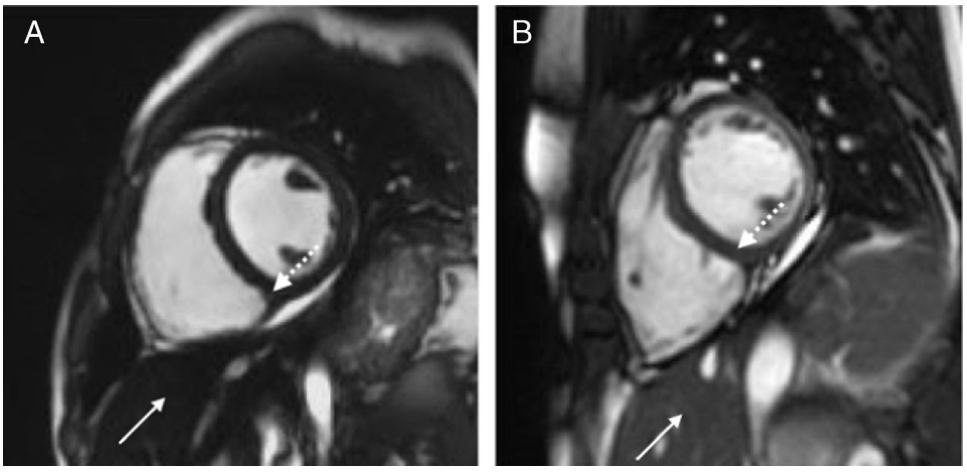

Figure 2 Midsegment short-axis steady-state free precession (SSFP) view of **A:** the patient's heart revealed that both the heart (dashed white arrow) and the liver (bold white arrow) have low signal intensity compared with that of **B**: a normal control.

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