



Contents lists available at ScienceDirect

Cardiovascular Revascularization Medicine



Outcomes after magnetic resonance imaging in patients with pacemakers and defibrillators and abandoned leads^{☆,☆☆}

Michael F. Morris^{a,b,*}, Divya Ratan Verma^{a,c}, Hasaam Sheikh^b, Wilber Su^{a,c}, Ashish Pershad^{a,c}

^a Cardiovascular Institute, Banner University Medical Center, Phoenix, United States

^b Department of Radiology, Banner University Medical Center, Phoenix, United States

^c Division of Cardiology, Banner University Medical Center, Phoenix, United States

Keywords:

MRI
Pacemaker
ICD
Safety

1. Introduction

Up to 75% of patients with a cardiac implantable electronic device (CIED), encompassing pacemakers and implantable cardioverter defibrillators, will be referred for magnetic resonance imaging (MRI) [1]. Current protocols for patients with both MRI conditional and non-MRI conditional CIEDs exclude patients with leads disconnected from their generator, termed 'abandoned' leads, due to safety concerns [2–4]. The outcomes of patients with CIEDs and abandoned leads undergoing MRI are uncertain.

2. Materials and methods

This was an institutional review board approved retrospective study of patients with both MRI conditional CIEDs and non-MRI conditional CIEDs undergoing MRI. Patients with MRI conditional CIEDs had their device programmed in accordance with the manufacturer's guidelines. Patients with non-MRI conditional CIEDs had their devices programmed into either an asynchronous mode (VOO/DOO) or a non-pacing mode (OVO/ODO) based on a preset algorithm (Fig. 1). In selected cases, patients with a CIED and an abandoned lead underwent MRI due to an urgent clinical need, as determined by consensus between the ordering physician and the radiologist. A chest radiograph was obtained prior to MRI to document lead position and to assess for the location and length of the abandoned lead.

All patients were scanned on a 1.5 T MRI scanner (Signa HD, General Electric, Milwaukee, Wisconsin), with the target specific absorption ratio <2 W/kg. During MRI, patients underwent continuous monitoring of their heart rate, heart rhythm, and pulse oximetry by an advanced practitioner certified in advanced cardiac life support with resuscitation equipment immediately available. No physician was present in the MRI suite. Patients were instructed to notify the MRI technician if they developed feelings of heating, palpitations, or any unfamiliar or uncomfortable sensation. Any changes in the physiologic monitoring or patient reported symptoms were logged. CIED settings were interrogated and recorded prior to MRI and immediately after MRI.

Categorical variables were described as proportions, and continuous variables as means and standard deviation (for normally distributed variables) or medians and interquartile range (for non-normally distributed variables). Comparisons were performed using chi-squared, Fisher's exact test, Student's *t*-test (for two groups), or analysis of variance (for >2 groups) as appropriate. All tests were two-sided with significance level of <0.05. Statistical analysis was conducted using Stata 14.2 (StataCorp, College Station, Texas, USA).

3. Results

231 patients with CIEDs underwent a total of 251 MRI scans between July 2016 and November 2017 (Table 1). Of the 251 MRI scans, 9 (4%) were in patients with abandoned leads. Patients with abandoned leads had an average age of 66 years (IQR 58–78), with 8 (89%) males. 4 patients had a pacemaker and 5 patients had an ICD, including one MRI conditional pacemaker and one MRI conditional ICD.

In the 9 patients with abandoned leads undergoing MRI, one abandoned lead was located in the SVC, one in the right atrium, one was epicardial, and six were in the right ventricle (Table 2). A total of 12 body regions were scanned during MRI, including 4 (33%) brain/neck, 3 (25%) lumbar spine, 3 (25%) extremity, 1 (8%) cervical spine, and 1 (8%) pelvis. Three patients had 2 body regions scanned during their MRI. The median MRI scan time was 26 min (IQR 21–30.5).

[☆] Disclosures: Dr. Pershad reports a financial relationship with Edwards Lifesciences. Dr. Morris reports a financial relationship with Medtronic. The remaining authors report no conflicts of interest regarding the content herein.

^{☆☆} This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

* Corresponding author at: 1111 E. McDowell Rd, Phoenix, AZ 85006, United States.
E-mail address: mfmorris@email.arizona.edu (M.F. Morris).

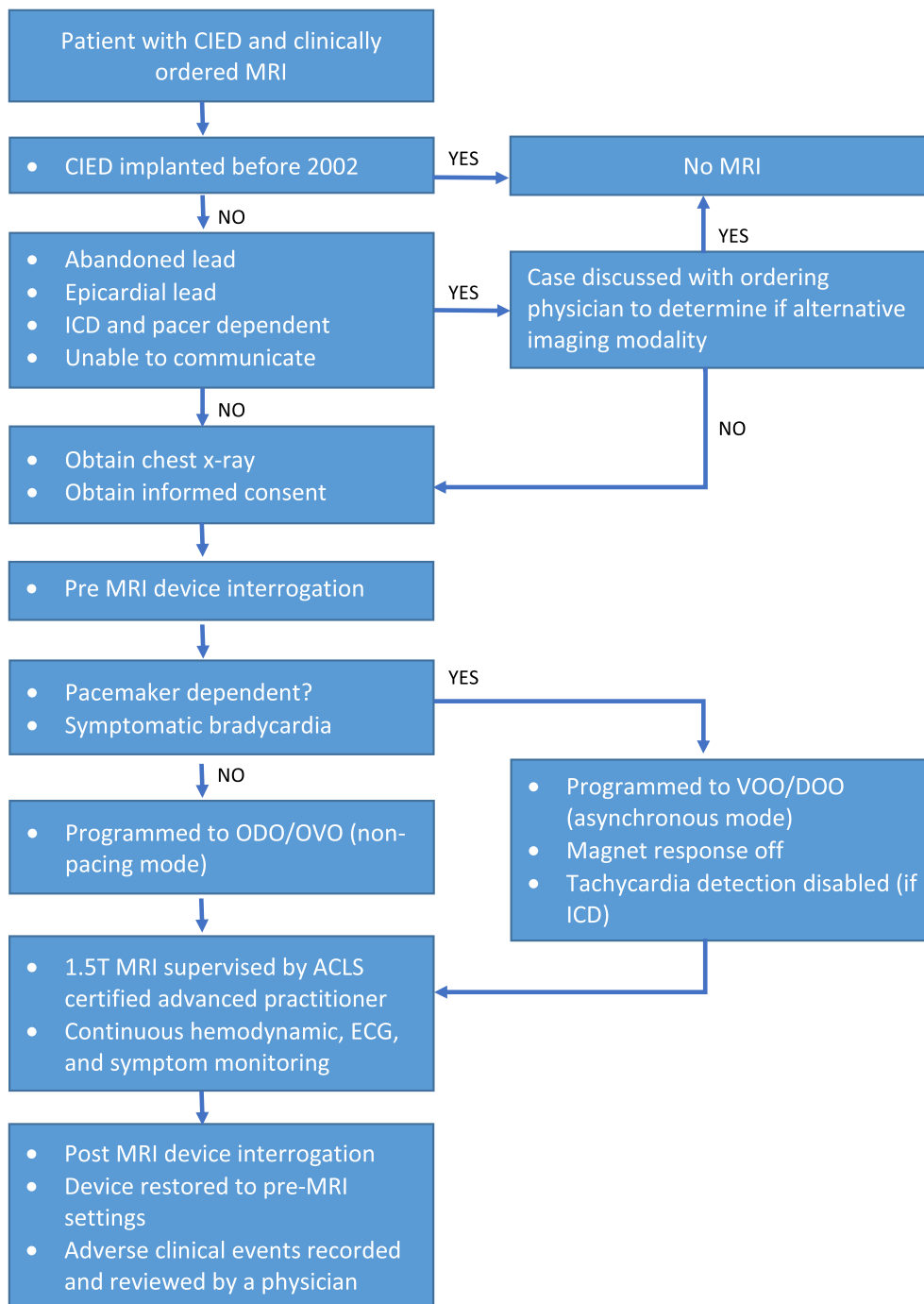


Fig. 1. Protocol for performing magnetic resonance imaging (MRI) in patients with MRI non-conditional cardiac implantable electronic device (CIED). Implantable cardiac defibrillator (ICD).

There were no significant changes in lead impedance, lead threshold, or battery voltage after MRI in patients with abandoned leads (Table 3), and no patient had a change in lead threshold or impedance of >50%. In addition, there were no significant differences in impedance and threshold values after MRI in patients with abandoned leads compared to patients with CIEDs and intact leads (Table 4). In all patients, there were no complications during or immediately after MRI, and no study was terminated early.

4. Discussion

Abandoned leads have been thought to pose risks to patients during MRI. These risks are based on *in vitro* studies demonstrating significant

heating at the lead tips, and the potential for abandoned leads to augment heating of adjacent active leads by altering coupling to the electromagnetic field [5]. Phantom studies have demonstrated a significant correlation between the length of the abandoned lead and the magnitude of heating, with leads up to 60 cm demonstrating the greatest rise in temperature [6]. Despite the safety concerns derived from experimental studies, the clinical relevance of these findings is uncertain [7]. Animals undergoing MRI scans with non-conditional CIEDs have demonstrated no histopathologic evidence of thermal injury [8], and humans with non-conditional CIEDs undergoing MRI scans have had no significant change in cardiac troponin T [9]. In addition, patients with abandoned leads undergoing MRI after removal of their CIED reported no significant adverse events [10].

Download English Version:

<https://daneshyari.com/en/article/11022569>

Download Persian Version:

<https://daneshyari.com/article/11022569>

[Daneshyari.com](https://daneshyari.com)