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CLINICAL CASE

Interference of biventricular ICD with radiofrequency application during ventricular tachycardia ablation in a pacemaker-dependent patient

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Summary

Electromagnetic devices may interfere with cardiovascular implantable electronic devices (CIEDs) in the hospital and outside. Ablation for the cardiac arrhythmia is increasing, and interference is a serious matter for the pacemaker-dependent patients during ablation procedure.

Keywords

Electromagnetic interference, ventricular tachycardia, ablation

Introduction

Usually the interference with implanted cardiovascular implantable electronic devices (CIEDs, pacemaker and implantable cardioverter defibrillators (ICDs)) occurs in the hospital environment. Prolonged inhibition of pacing function may cause serious complications in pacemaker-dependent patients. We report electromagnetic interference of biventricular ICD with radiofrequency (RF) application during ventricular tachycardia (VT) ablation in a pacemaker-dependent patient.

Case report

A 57-year old man presented to our clinic with palpitation. He had a history of coronary artery by-pass op-

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eration 8 years ago. A biventricular ICD was implanted one year ago in order to treat congestive heart failure symptoms and atrioventricular (AV) block. Electrocardiography (ECG) during palpitation episode revealed monomorphic VT. He had several VT episodes treated by ICD shocks despite being on amiodarone and beta blocker therapy. The patient was admitted to the electrophysiology laboratory for VT ablation. After sedation, RF catheter was advanced to the left ventricle (LV). Basal intracardiac measurements were normal. 3-D LV anatomy was constructed by using CARTO system. VT was induced by programmed ventricular stimulation and had a left bundle branch block (LBBB) pattern with inferior axis. The earliest ventricular activity during VT was adjacent to para-Hisian region at left ventricular outflow tract. VT was ablated successfully. A second VT was induced which had a right bundle branch block (RBBB) pattern and superior axis. Because the VT was not sustained mapping was not possible. Subsequently, another VT with RBBB pattern was induced. Since this VT was very fast and caused hemodynamic collapse, we had to perform cardioversion. Because one of the VTs was non-sustained and the other one was not tolerated hemodynamically, we decided to perform substrate ablation. During RF applications at the close vicinity of the defibrillator lead (Figure 1), transient complete inhibition of pacing was realized (Figure 2). No further RF application was possible because AV block. The pacing mode of the device was switched to V00 and after that we were able to finish our RF ablation. Scar mapping of the LV was constructed. There was a wide scar in the basal part of posterior and inferior LV wall. RF ablation was also performed in the scar area and RF line was created from the scar area to the mitral annulus. Finally there was not any inducible VT.

Discussion

There is an increasing trend in the need of CIEDs for the treatment of heart failure and arrhythmia [1]. In these circumstances, active patients with CIEDs face the risk of electromagnetic interference (EMI) during their daily life.

EMI is a situation that affects an electrical circuit due to either electromagnetic induction or electromagnetic radiation emitted from an external source. There were some attempts in order to reduce EMI; the filtering systems of the devices were improved, the properties that distinguish intracardiac signals were supported and the devices were concealed [2]. Cellular phones, digital media players, headphones, airport security detectors, product surveillance devices and bioelectric impedance analyzers used to measure body fat were reported as outpatient environmental causes of EMI [3,4]. However, in-hospital causes of EMI may be listed as electrosurgery, radiotherapy, cardioversion, left ventricular assist devices, lithotripsy, magnetic resonance imaging (MRI) and RF ablation as it is the case in our report [5]. Oversensing resulting from EMI may cause transient pause in the pacing function, asynchronous pacing, ventricular tracking, enhanced or inhibited pacing and errors in tachyarrhythmia interpretation function of ICDs. Especially when exposed to the static magnetic field of MRI, the pacemaker faucet may move inside the pocket and the electrodes may warm-up causing thermal injury.

RF ablation is commonly used for the treatment of cardiac arrhythmias [6]. During the procedure while signals are transmitted in a unipolar fashion between

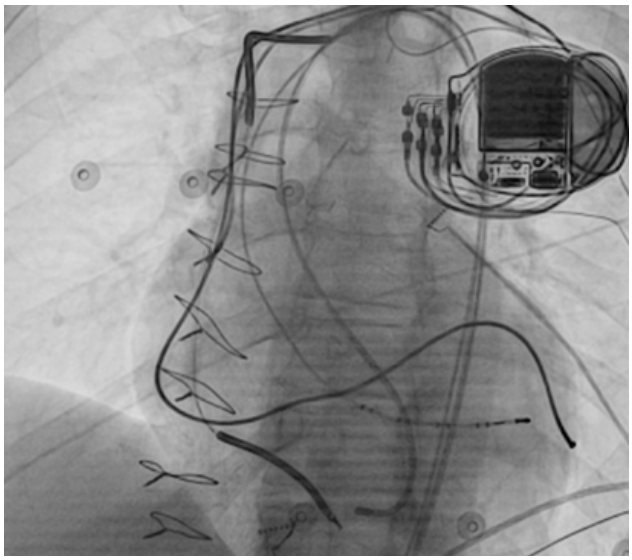

Figure 1. During RF applications at the close vicinity of the defibrillator lead and RF catheter

Figure 2. Revealing transient complete inhibition of pacing

the tip of the catheter and the grounding patch, there is a risk of EMI [7]. In our case, after VT was induced and during RF application approximate to the pace lead, EMI occurred and pause was recorded. In ablation procedures using RF in patients with CIEDs, EMI has been reported in various cases and studies [8,10]. During ablation procedures performed using RF, it is crucial to turn off anti-tachycardia treating properties of ICD devices and switch to asynchronous mode in pacemaker dependent patients. Furthermore device settings should be checked after the procedure.

Conclusion

In conclusion, RF application may interfere with cardiac devices and may inhibit pacemaker function in pacemaker dependent patients. Temporary pacing or switching the pacing mode to V00 may be necessary.

Conflict of interest: None declared

References

1. Mond HG, Proclemer A. The 11th world survey of cardiac pacing and implantable cardioverter-defibrillators: calendar year 2009 – a World Society of Arrhythmia's project. Pacing Clin Electrophysiol. 2011 Aug;34(8):1013-27.
2. Porres JM, Laviñeta E, Reviejo C, Brugada J. Application of a clinical magnet over implantable cardioverter defibrillators: Is it safe and useful? Pacing Clin Electrophysiol. 2008;31:1641-5.
3. Misiri J, Kusumoto F, Goldschlager N. Electromagnetic interference and implanted cardiac devices: the medical environment (part II). Clin Cardiol. 2012 Jun;35(6):321-8.
4. Tandogan I, Ozin B, Bozbas H, et al. Effects of mobile telephones on the function of implantable cardioverter defibrillators. Ann Noninvasive Electrocardiol. 2005 Oct;10(4):409-13.
5. Levine GN, Gomes AS, Arai AE, et al. Safety of magnetic resonance imaging in patients with cardiovascular devices. 2007 Dec 11;116(24):2878-91.
6. Vadmann H, Gerdes C, Pehrson S, et al. [Radiofrequency ablation of atrial fibrillation.] Ugeskr Laeger. 2013 Oct 21;175(43):2553-2557. Danish.
7. Lakkireddy D, Patel D, Ryschon K, et. al. Safety and efficacy of radiofrequency energy catheter ablation of atrial fibrillation in patients with pacemakers and implantable cardiac defibrillators. Heart Rhythm. 2005 Dec;2(12):1309-16.
8. Siu CW, Tse HF, Lau CP. Avoidance of electromagnetic interference to implantable cardiovertor-defibrillator during atrioventricular node ablation for atrial fibrillation using transvenous cryoablation. Pacing Clin Electrophysiol. 2006 Aug;29(8):914-6.
9. Fiek M, Dorwarth U, Durchlaub I, et al. Application of radiofrequency energy in surgical and interventional procedures: are there interactions with ICDs? Pacing Clin Electrophysiol. 2004 Mar;27(3):293-8.
10. Sadoul N, Blankoff I, de Chillou C, et.al. Effects of radiofrequency catheter ablation on patients with permanent pacemakers. J Interv Card Electrophysiol. 1997 Nov;1(3):227-33.