

Case report

QJM

Shock whilst gardening—implantable defibrillators & lawn mowers

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Summary

Electromagnetic interference with implantable cardioverter defibrillators (ICDs) can cause inappropriate shock delivery or temporary inhibition of ICD functions. We present a case of electromagnetic

interference between a lawn mower and an ICD resulting in an inappropriate discharge of the device due to erroneous detection of ventricular fibrillation.

Learning Point for Clinicians

Clinicians are continuously faced with curious implantable cardioverter defibrillator (ICD) findings including electromagnetic interference. They should be well-informed on potential sources of electromagnetic interference and their handling. We recommend ICD recipients to keep a safe distance of >30 cm between combustion engines of this type in order to avoid electromagnetic interference.

Case report

A 77-year-old patient with coronary artery disease and severely reduced left ventricular ejection fraction was supplied with an ICD 12 years ago, having survived ventricular fibrillation through successful cardiopulmonary resuscitation. Recently, he presented for a routine follow-up of his ICD without any specific complaints. Parenthetically, the patient mentioned experiencing an electric shock while bending

over the engine of his 10-year-old lawn mower (HONDA lawn mower, combustion engine GCV 135, HONDA, Tokyo, Japan) a few months ago.

Interrogation of the ICD showed normal lead values and did not point towards any device or lead malfunction. However, the ICD Holter revealed one episode of electromagnetic interference with erroneous detection of ventricular fibrillation and subsequent delivery of a 35 J shock (Figure 1). This coincided with the reported incident. After the shock, the patient immediately kept his distance from the engine. Normal bifocal stimulation was restored. Thus, the electric impulse striking the patient did not originate from the lawn mower but from the ICD.

Upon further questioning it turned out that the patient had been using the same lawn mower for several years without any problems, however he always kept a distance of >30 cm between his chest and the engine. Without any apparent defect of the lawn mower, especially no short circuit, we advised the patient to continue using his lawn

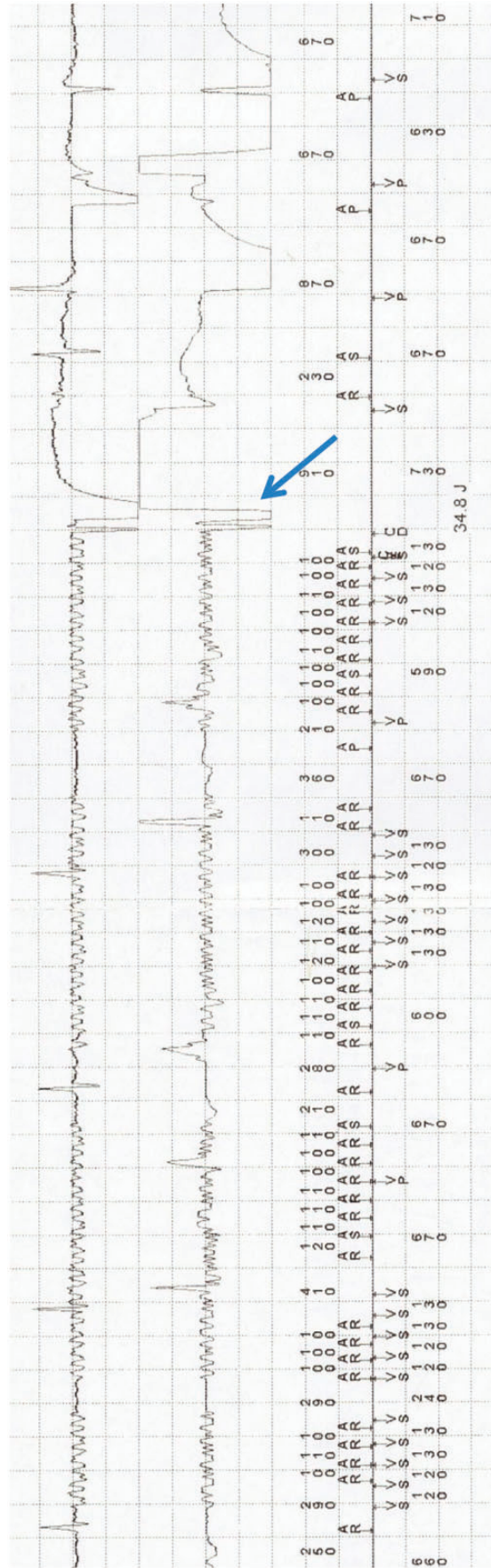


Figure 1. Episode stored in the ICD memory showing the atrial electrogram (first line), the ventricular electrogram (middle line) and marker and interval annotations (bottom line). Intrinsic atrial rhythm and paced ventricular rhythm is overlapped by highly regular signals of the electromagnetic field of the lawn mower engine causing inappropriate detection of ventricular fibrillation and subsequent ICD discharge (arrow). The patient steps away from the lawn mower and no further interference is present thereafter.

mower while keeping his habitual safe distance to the engine. During a follow-up of 6 months no further complications occurred.

Given the current ICD implantation rates, every family and general practitioner in the United States will be faced with one new ICD recipient among his/her patients every 2 years. Any of these patients may present with the feeling of an ICD discharge while being exposed to an electromagnetically hostile environment.

Although a detailed medical history may help with identifying the aetiology of the electric shock, device interrogation is the only way to differentiate between several possible scenarios: (i) Electric shock caused by defective household devices themselves as presumed by our patient. (This can occasionally result in damage of the implanted device but would otherwise not show any abnormalities during device interrogation.); (ii) The event of true ventricular or supraventricular tachyarrhythmias accidentally coinciding with contact with an external electronic device (According electrograms should then be detectable in the device memory.); (iii) The highly unlikely event of unmasking lead defects during the exposure to electromagnetic fields (This would reveal abnormal lead values or electrogram findings during device interrogation.); (iv) Electromagnetic interference causing inappropriate ICD discharges which would show typical electrograms with oversensing (as in our case); or (v) The presence of a 'phantom shock' (e.g. the sensation of an ICD discharge in the absence of any electrical discharge).

Although electromagnetic interference triggering inappropriate ICD shocks is rare and accounts for

<1 shock per 100 patient-years,^{1–3} adequate patient information on potential sources of electromagnetic interference is important and determination of the culprit may save the patient unnecessary restrictions and or costs.

Funding

H.P. was supported by a fellowship of the European Heart Rhythm Association (EHRA).

Conflict of interest: C.K. has received lecture honorary or travel support from Biotronik, Boston Scientific, Medtronic, St. Jude Medical and Sorin; he is a consultant to Biotronik and Sorin and performs/has performed clinical studies which were supported by Biotronik, Medtronic, St. Jude Medical, Sorin and Stereotaxis.

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