

Inappropriate ICD discharge induced by electrical belt stimulation for muscle-building

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Summary

We describe the case of a 57-year-old man who had received a biventricular ICD (implantable cardioverter-defibrillator) 2 years previously for malignant ventricular arrhythmia and cardiac arrest in the setting of ischaemic heart disease. He experienced inappropriate ICD shock with the use of a belt stimulation for muscle building.

Key words: ICD; inappropriate discharge; TENS, electrical belt; abdominal stimulation

Case history

We describe the case of a 57-year-old man who had received a biventricular ICD (implantable cardioverter-defibrillator) (Paradym RF DR 9550, Sorin, Milan, Italy) two years previously for malignant ventricular arrhythmia and cardiac arrest in the setting of ischaemic heart disease.

He was admitted to our hospital after having received an ICD discharge. One month before admission, he started to use an electrical-stimulation abdo-

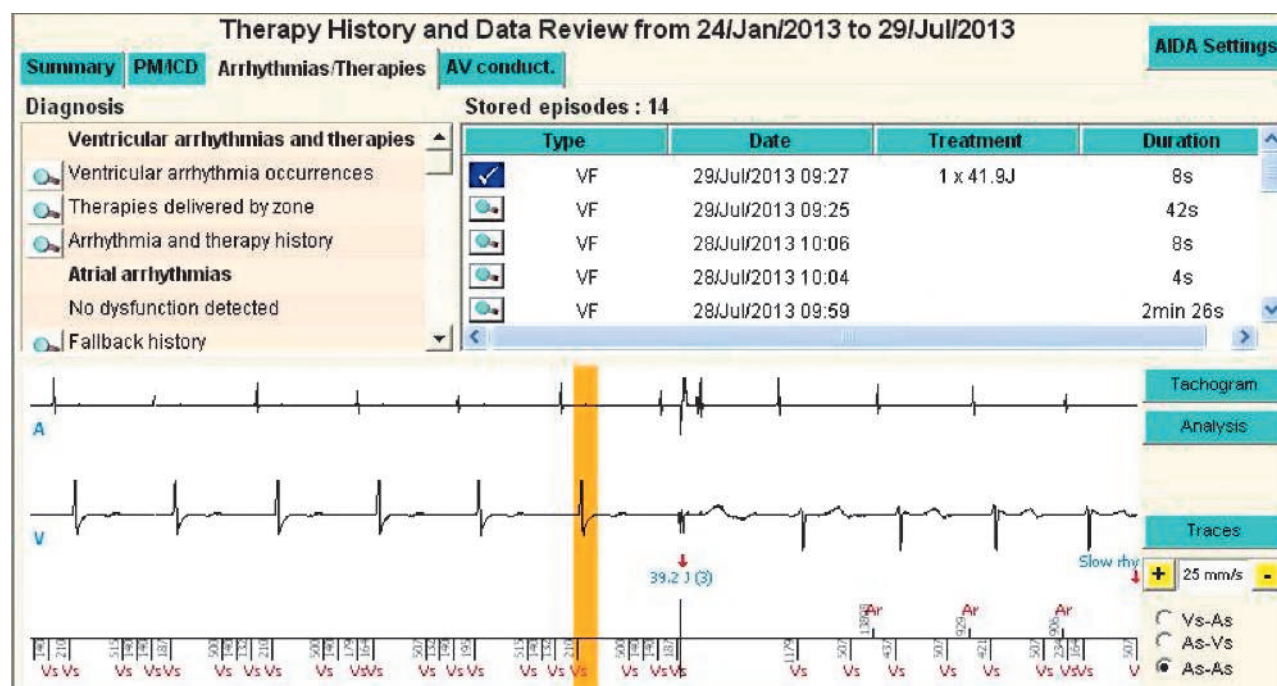


Figure 1

Screen shot of the ICD recording. Clearly the EGM recording shows normal sinus rhythm (channel 1 and 2) although the system detects sustained ventricular arrhythmias (VS) on the 3rd channel. Inappropriate discharge was then delivered (39.2 J) as indicated.

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Abbreviations

bpm beats per minute
EMI electromagnetic interference
ICD implantable cardioverter-defibrillator
TENS transcutaneous electrical nerve stimulation
VS ventricular beats

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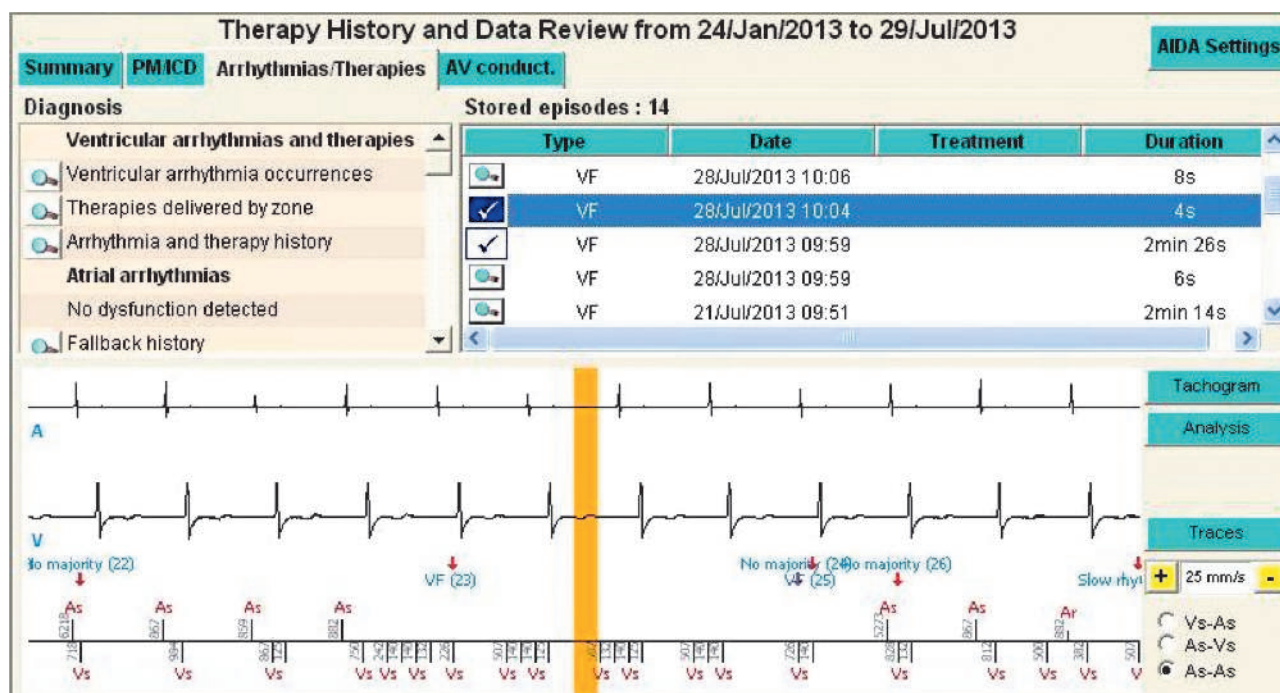


Figure 2

Rapid accelerated rhythm detected and interpreted as ventricular fibrillation. The cessation of the EMI signal after a few seconds, leads to interpretation of a non-sustained arrhythmia. This behaviour was recorded during the month preceding the shock. The cessation of the signal explained why the device did not discharge at that time.

minimal belt (Ab Maxx II Pro, DS Produkte GmbH, Galin, Germany) for the purpose of muscle-building. Analysis of the stored electrocardiogram showed 30 events of electromagnetic interference (EMI) with the external stimulation during the month preceding the ICD discharge. Activity of the electrical belt was sensed by the ICD as ventricular beats (VS). In spite of two to three daily sessions of 30 minutes stimulation, inappropriate discharge occurred after only 1 month (fig. 1). Of note, on this figure, the noise detected by each lead is not visible. For technical reasons, we cannot provide a figure showing the noise, since the amplitude is too small to be clearly seen.

Inappropriate discharge occurred because the abdominal belt was used twice in a short period of time (within 2 minutes), allowing the ICD to detect the belt activity as VS and to charge the condenser. As the belt activity carried on and continued to be detected, the ICD interpreted it as a sustained arrhythmia and delivered an inappropriate therapy. During previous use of the belt, analyses showed the same interference every time, but the ICD did not complete the charging due to loss of signal leading to the interpretation of a non-sustained rhythm (i.e., a rhythm not lasting enough to be interpreted as a ventricular tachycardia needing defibrillation). The electrocardiogram recorded on the device showed a perfect correlation between activity of the belt and detection of ventricular arrhythmias by the ICD (fig. 2). Of note, device interro-

gation before the patient started using his belt, had never shown inappropriate detection of VS. After consulting at our clinic, he stopped using the belt, and no further EMI were observed during subsequent device analyses (i.e., 1 and 3 months later). EMI with daily life devices have been reported. Our case is the third reported clinical situation of inappropriate shock delivered during abdominal belt use [1]. Therefore it seems quite evident that their use must be prohibited in patients with ICD. The manufacturer of our patient's ICD (Sorin, Milan, Italy) mentioned this restriction in its user manual. The manufacturer of the belt states in the user manual that the patient should question his physician, which our patient did. The physician erroneously allowed him to use his stimulation belt.

A similar example is found in the literature regarding transcutaneous devices used for medical purposes. The use of transcutaneous electrical nerve stimulation can also lead to inappropriate ICD discharge, regardless of the application site of the electrode [2–4]. Thus the use of TENS in patients with ICD is strictly discouraged and restricted to particular conditions. Patients and physiotherapists should be informed about this potential interaction.

Because of the potentially serious consequences of electrical interferences, in particular over-sensitivity leading to inhibition of ventricular pacing in pace-dependant patients or to inappropriate therapy in defibrillators, the use of TENS or abdominal stimulation

units must be avoided in patients with ICD. General practitioners and cardiologists should be aware of these interferences and refer the patient to the ICD and stimulation device manufacturer in case of doubt. Clearly, patients and physician information should be provided in the manual user of ICD's and electrical devices with potential EMI. A list of devices leading to interferences is provided on the website of the Swiss Heart Foundation [5], but abdominal stimulation units are not mentioned. This highlights the fact that such cases should be reported to raise awareness about possible new sources of EMI.

References

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