Cor et Vasa

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/crvasa

Kasuistika | Case report

An anomalous case of S-ICD malfunctioning: A big trouble or a soap bubble?

Pasquale Crea, Angela Nicotera, Bruna Crea, Antonio Taormina, Giuseppe Picciolo

Department of Clinical and Experimental Medicine, Cardiology Unit, University of Messina, Italy

ARTICLE INFO

Article history:
Received: 29. 4. 2017
Received in revised form: 21. 5. 2017
Accepted: 29. 5. 2017
Available online: 2. 8. 2017

Klíčová slova:
Detekce šumu
Hluk
Neadekvátní výboj
Subkutánní ICD
Uvězněný vzduch

SOUHRN

Dvanáct hodin po implantaci subkutánního ICD přístroj aplikoval neadekvátní výboj pro detekci šumu. Kontrola ICD prokázala nedostatečné vnímání intrakardiálních signálů na primární vektor a významný zvukový artefakt na alternativním vektoru. Překvapivým zjištěním byla úplná obnova vnímání primárního vektoru po dvou dnech. Pravděpodobnou příčinou malfunkce byl vzduch uvězněný v podkožní kapse během implantace.

Keywords:
Air trapping
Inappropriate shocks
Noise
Oversensing
Subcutaneous ICD

ABSTRACT

12 h after the implant of a S-ICD the patient accused an inappropriate shock due to noise oversensing. ICD interrogation showed undersensing of ventricular signals on primary vector and significative noise on alternative vector. Surprisingly, 2 days full recovery of sensing of primary vector was observed. Trapped air was likely to be the cause of malfunctioning.

Address: Pasquale Crea, MD, Department of Clinical and Experimental Medicine, University of Messina, Via Consolare Valeria, 98124 Messina, Italy,
e-mail: pasqualecrea@hotmail.it
DOI: 10.1016/j.crvasa.2017.05.016

Please cite this article as: P. Crea, et al., An anomalous case of S-ICD malfunctioning: A big trouble or a soap bubble?, Cor et Vasa 60 (2018) e472–e474 as published in the online version of *Cor et Vasa* available at https://www.sciencedirect.com/science/article/pii/S0010865017300863

Case presentation

A 75-year-old male, affected by permanent atrial fibrillation and idiopathic dilated cardiomyopathy with low left ventricular ejection fraction (EF 25%), was implanted, in October 2016, with a single chamber ICD for primary prevention of sudden death. One month later, the patient showed a pocket hematoma needing implant revision. In January 2017, he was admitted to our hospital for up to 50 inappropriate shocks, due to oversensing by lead dislodgement. The device was completely discharged. We discussed with the patient our strategy. We evaluated the high-risk of infection in case of pocket reopening (it would have been the third one in four months) and lead reposition. The patient didn't need antibradycardia therapy. A surface ECG screening for S-ICD was performed and the patient resulted eligible with 3/3 ECG leads. Thus, we decided to explant transvenous ICD and to implant a subcutaneous ICD (Device: A219 EMBLEM MRI S-ICD Boston Scientific; Lead: 3401).

The device was programmed with a conditional zone between 200 beats/min and 220 beats/min and a shock zone for rates greater than 220 beats/min. Sensing was from the primary vector (adequate signals; see Fig. 1C1).

12 h after the implant the patient accused an inappropriate shock due to noise oversensing (see Fig. 1A). 30 s post-defibrillation pacing followed the shock. Signals analysis of the three vectors, performed just after the shock, (see Fig. 1C2) showed undersensing of ventricular signals on primary vector (quite mute channel) and significative noise on the alternative vector. Secondary vector was normal. An anomaly involving the proximal electrode of the lead (located near the xyphoid process) was suspected. Therapies were switched off and the patient underwent continuous ECG monitoring. Fluoroscopic review of the lead and set-screw positioning was unremarkable. Manipulation of the device did not influence the signals. Surprisingly, 2 days after the procedure a new interrogation of the device showed the full recovery of sensing of primary vector (see FIG. 1B3). A temporary insulation of the proximal lead, probably related to trapped air, was likely to be the cause of malfunctioning. For safety reasons, sensing was programmed from the secondary vector (the only one ever affected by noise). Therapies were switched on and the patient was discharged. No further intervention was performed at that stage and no over sensing recurrence. He proceeded to have an event free six-week follow-up.

Discussion

The S-ICD is an alternative to conventional transvenous ICD. It avoids intravascular lead failures and minimizes operative complications. However, inappropriate shocks from the S-ICD are a known cause of morbidity [1]. The inappropriate shock rates (about 7%) are comparable with the standard transvenous ICD. While in transvenous ICDs inappropriate therapies are primarily due to supraventricular arrhythmias, in S-ICD the main cause of inappropriate shocks is T-wave oversensing. Oversensing of external interferences and supraventricular tachycardia counts for a minor part [2].

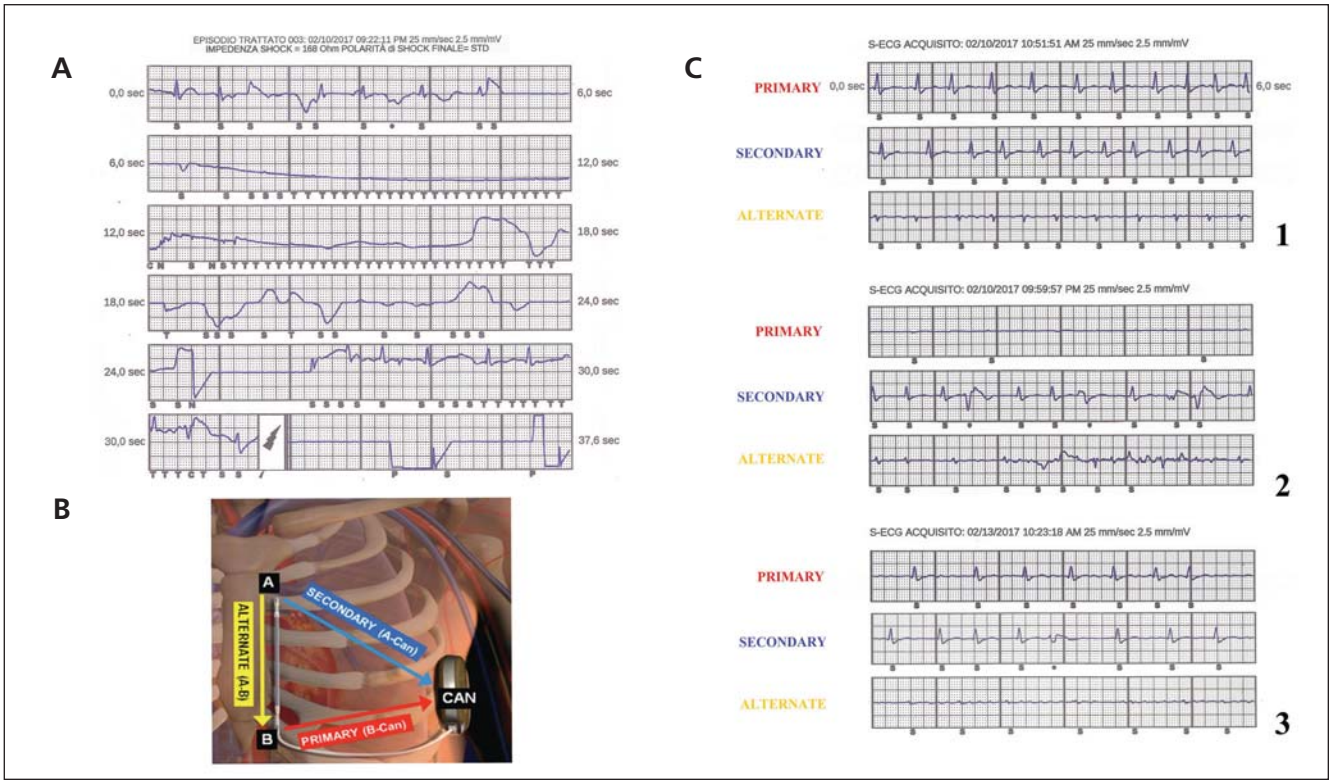

Fig. 1 – (A) Inappropriate shock due to noise oversensing; (B) the three sensing vectors of S-ICD; (C) 1 – EGMs after implant, 2 – EGMs immediately after the inappropriate shocks, showing undersensing of ventricular signals on primary vector (quite mute channel) and significative noise on the alternative vector, 3 – EGMs two days later, showing the full recovery of sensing of primary vector.

Several discrimination algorithms have been introduced to traditional ICD without eliminating the problem of inappropriate shocks. The S-ICD has options for management of inappropriate shocks including reprogramming of the sensing vector.

Air entrapment within the distal or proximal lead may produce S-ICD system malfunction if the sensing contact ring becomes insulated by the accumulation of air in the pocket. In our case, air entrapment insulated the proximal electrode from surrounding tissue. This intermittent tissue contact led to oversensing, erroneously detected as ventricular fibrillation. Two similar cases were reported in literature [3,4].

In both cases S-ICD malfunctioning occurred during the first day after implant and complete resolution happened within 48 h. The air is able to intermittently alter the baseline contact between the normally separated extracellular fluid and the conductive elements of the lead. Once the air is fully absorbed by surrounding tissues the malfunction ceases.

Boston Scientific suggests using standard surgical techniques to obtain good tissue contact, flushing the tissue with sterile saline, and taking care not to introduce air into the subcutaneous tissue. Prompt recognition of this malfunctioning is important to prevent early inappropriate shocks. Correct management includes the temporary switch off of ICD therapy, ECG monitoring and waiting. A focused RX can help diagnosis, highlighting air entrapment. Pocket reopening can be avoided if the malfunctioning ceases spontaneously within 48 h.

Conflict of interest
None of the authors has any conflict of interest.

Funding body
None.

Ethical statement
Authors state that the research was conducted according to ethical standards.

Informed consent
The patient was asked to consider allowing Dr. Pasquale Crea to use his medical records to write a case report. The case report has been fully explained to the patient and all questions have been answered. We explained the objective of this manuscript to the patient, share information experienced by one patient during his clinical care that may be useful for other physicians and members of a health care team, and may be published in *Cor et Vasa* journal for others to read. The patient authorized access to his personal health information and he has agreed to participate in this case report.

References

[1] V. Essebag, J. Champagne, D.H. Birnie, et al., Nonphysiologic noise early after defibrillator implantation in Canada: incidence and implications: a report from the Canadian Heart Rhythm Society Device Committee, Heart Rhythm 9 (2012) 378–382.
[2] D. Wilson, A. Yue, P.R. Roberts, J.M. Morgan, Oversensing and shock delivery in the S-ICD: five shocks two mechanisms, Pacing and Clinical Electrophysiology 38 (2015) 1009–1013.
[3] S.C. Yap, R. Bhagwandien, T. Szili-Torok, D.A.M.J. Theuns, Air entrapment causing early inappropriate shocks in a patient with a subcutaneous cardioverter-defibrillator, HeartRhythm Case Reports 1 (2015) 156–158.
[4] M.M. Zipse, W.H. Sauer, P.D. Varosy, et al., Inappropriate shocks due to subcutaneous air in a patient with a subcutaneous cardiac defibrillator, Circulation: Arrhythmia and Electrophysiology 7 (2014) 768–770.