

Electrocautery-induced Inappropriate Implantable Cardiac Defibrillator Shock

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Inappropriate implantable cardiac defibrillator (ICD) shock due to electromagnetic interference (EMI) induced by electrocautery is a well-known theoretical association but is rarely reported [1]. We report a case of EMI induced by electrocautery causing inappropriate ICD shock, underlining that, with the use of monopolar cautery, not only the location of the surgery but also electrodispersive pad (EDP) placement may be important to avoid EMI.

PATIENT DESCRIPTION

A 72-year-old patient underwent surgery because of recurrent left inguinal hernia. He had a history of myocardial infarction, hypertension, diabetes mellitus, peripheral vascular disease, chronic obstructive lung disease, paroxysmal atrial fibrillation, left bundle branch block, and left ventricular ejection fraction of 25%. Three years earlier, the patient underwent implantation of cardiac resynchronization therapy defibrillator (CRT-D; Quadra Assura MP 3371-40 QC, Abbott, USA) because of cardiac arrest second-

ary to ventricular fibrillation (VF). The CRT-D detection and treatment were programmed to monitor only in the ventricular tachycardia zone and for therapy with antitachycardia pacing while charging and delivery of 30J–40J in the VF zone that was set at 214 bpm (280 ms) and 12 intervals. Brady parameters were set to VVIR mode at a lower rate of 50 and an upper rate of 110 bpm. Programmed ventricular sensitivity was set at 0.5 mV.

On the day of surgery, the patient was placed in the supine position and the EDP on his left flank. The surgery was conducted with the use of monopolar electrocautery and the CRT-D defibrillated. The surgical procedure was paused and a magnet was placed on the CRT-D. The procedure was completed with no complications.

A subsequent CRT-D interrogation confirmed its normal functioning and inappropriate intraoperative 30 joule shock due to EMI [Figure 1].

COMMENT

Many patients with ICD undergo surgical procedures that use electrocautery, particularly monopolar devices, and require a dispersive electrode (EDP) applied to the patient's skin to complete the electrical circuit. It has been suggested that the EDP be positioned to direct its returned current away from the pulse generator

and lead to reduce the risk of EMI [2]. The most common cause of EMI is electrocautery, although it is rare during bipolar electrocautery [2].

Using monopolar devices for cardiac and non-cardiac surgery superior to umbilicus, a high occurrence of EMI has been reported despite different placement of EDP [2]. Therefore, the cardiac implantable electronic device should be altered to an asynchronized pacing mode in the pacing dependent patient. That ICD's antitachycardia function should be suspended [2].

It has been reported that the risk of EMI does not occur in any lower abdominal or extremity procedures [3], implying that suspending antitachycardia therapy is unnecessary in these patients [2,3]. However, EMI due to monopolar electrocautery in lower abdominal surgery was reported [4].

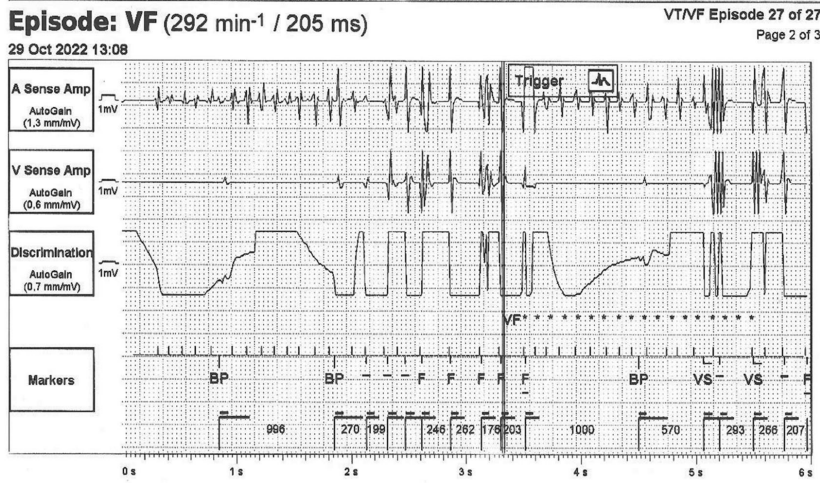
During pelvic surgery using monopolar electrocautery the EDP was proposed to be positioned on the thigh or buttock contralateral to the side of surgery [2]. Our patient underwent surgery under the umbilicus and the EDP was placed on the left flank. The EDP returned current might have interfered with the CRT-D and caused EMI.

In the case reported by McGuire and colleagues [4], the EDP was repositioned from the left to the right flank in addition to placing a magnet over the ICD after the inappropriate ICD shock during monopolar cautery. The

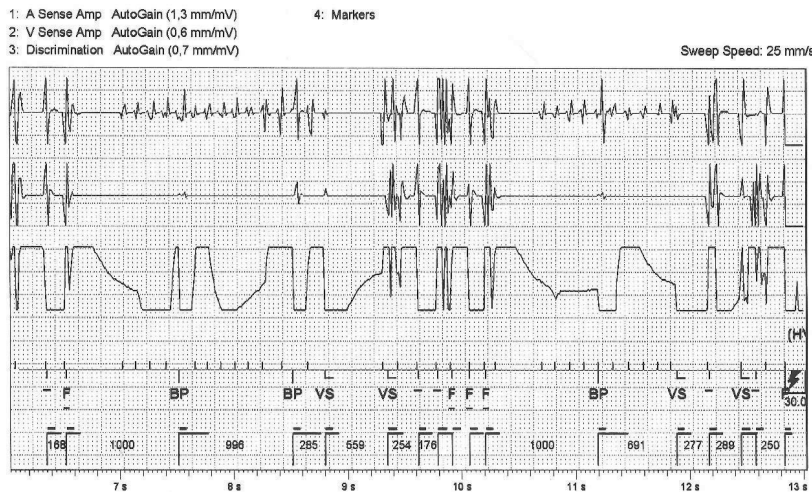
Figure 1. Stored electrogram from the CRTD
 First line: atrial electrogram channel
 Second line: ventricular electrogram channel
 Third line: far field electrogram channel; forth line: marker annotations

CRTD = cardiac resynchronization therapy defibrillator

[A] Artefacts are seen in all channels and are erroneously interpreted as ventricular fibrillation (VF)



[B] CRTD discharges of 30 joule shock ()



use of the magnet to inhibit ICD anti-tachycardia therapy makes it difficult to determine the effect of the placement of EDP to a different location on the risk of EMI. However, the use of the magnet was effective in avoiding inappropriate shock in both cases.

EDP location is important to divert the current return pathway away from the ICD; however, guidelines regarding EDP placement in patients with an ICD or pacemaker are practically non existing and based on expert consensus or isolated case

reports [5]. Further research is required to improve recommendations for ICD perioperative management in surgery below the umbilicus.

By using monopolar electrocautery, not only the location of surgery but also EDP placement may have an important role in avoiding inappropriate shock due to EMI. Given the limited evidence regarding the efficacy of optimal EDP positioning in various types of surgery, it remains prudent to place a magnet over the ICD to suspend the antitachycardia therapy while monopolar electrocautery is used.

CONCLUSIONS

During monopolar electrocautery below the umbilicus, ICD inappropriate shock due to EMI occurs, although rarely.

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