Case Reports

Implantable Cardioverter-Defibrillator Shock

after Stenting Across the Device Leads

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A 45-year-old man with nonischemic cardiomyopathy and end-stage renal disease had lived uneventfully with a cardiac resynchronization therapy defibrillator (CRT-D) for 5 years. Less than a month before presenting at our institution, he had undergone stenting of his partially occluded subclavian vein, to relieve stenosis of the ipsilateral arteriovenous fistula that was used for his hemodialysis. The CRT-D subsequently discharged. Device interrogation revealed that electrical noise originating from leads damaged by the stent had caused the inappropriate shock and intermittent electrical discharges thereafter. The patient was highly traumatized by these events and insisted upon device removal, which deprived him of a potentially life-saving intervention. He later had a cardiac arrest that resulted in sustained profound hypoxic ischemic encephalopathy with minimal neurologic recovery: his family placed him in a long-term care facility on ventilator support, with a tracheostomy and feeding tube. This situation might have been avoided through collaboration between the interventional radiologist and the electrophysiologist. To our knowledge, this is the first report of a patient with nonischemic cardiomyopathy and end-stage renal disease who presented with inappropriate defibrillator discharge caused by lead damage secondary to stenting across the leads. ***(Tex Heart Inst J 2016;43(1):88-90)***

Key words: *Cardiac pacing, artificial; death, sudden, cardiac/prevention & control; defibrillators, implantable/adverse effects; device removal/education; equipment failure; kidney failure, chronic/therapy; prosthesis implantation/adverse effects; stents/adverse effects; stress, psychological/etiology; treatment refusal*

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Implantable cardioverter-defibrillators (ICDs) significantly lower mortality rates in survivors of sudden cardiac arrest and in high-risk patients who have cardiovascular disease.[1-3] However, ICD discharge can occur for reasons other than ventricular tachycardia or fibrillation. In a study of 1,544 patients who had ICDs, 13% of the patients received inappropriate shocks, usually after misdiagnosis of supraventricular tachycardia.[4] We present the case of a patient whose inappropriate ICD discharge was caused by the interaction of a stent with the device leads.

Case Report

In April 2014, we evaluated a 45-year-old man who presented after an ICD shock. The patient had nonischemic cardiomyopathy; 5 years earlier, a left prepectoral COGNIS® Model N119 cardiac resynchronization therapy defibrillator (CRT-D) (Boston Scientific Corporation; St. Paul, Minn) had been implanted (Fig. 1A) for primary prevention of sudden cardiac death (SCD). The patient's ICD shock, his first, had occurred during an argument with his spouse. In addition, electrical sensations in the region of the defibrillator generator had caused intermittent involuntary motions of his left arm for several days.

The patient had end-stage renal disease and had undergone hemodialysis for 4 years. Dialysis access was through a left-arm arteriovenous (AV) shunt. Thrombosis of this shunt had prompted a declotting procedure 3 to 4 weeks before the presenting symptoms. A stent, then placed to relieve stenosis of the patient's left subclavian vein, extended partially across the CRT-D leads (Fig. 1B). Device interrogation revealed electrical noise on the right ventricular (RV) and right atrial leads. The episode before the ICD discharge was caused by noise on the RV lead (Fig. 1C). The noise on the right atrial and RV channels was reproducible during isometric exercise (Fig. 1D).

The patient was highly traumatized by the ICD discharge and left-arm involuntary motions. He requested the cessation of all defibrillation therapies. Accordingly, pacing was completely turned off, and the electrical discharges subsided. Despite extensive discussions regarding the risk of SCD and an offer of specialized psychological counseling, the patient continued to decline a new ICD. The generator was later explanted at his request.

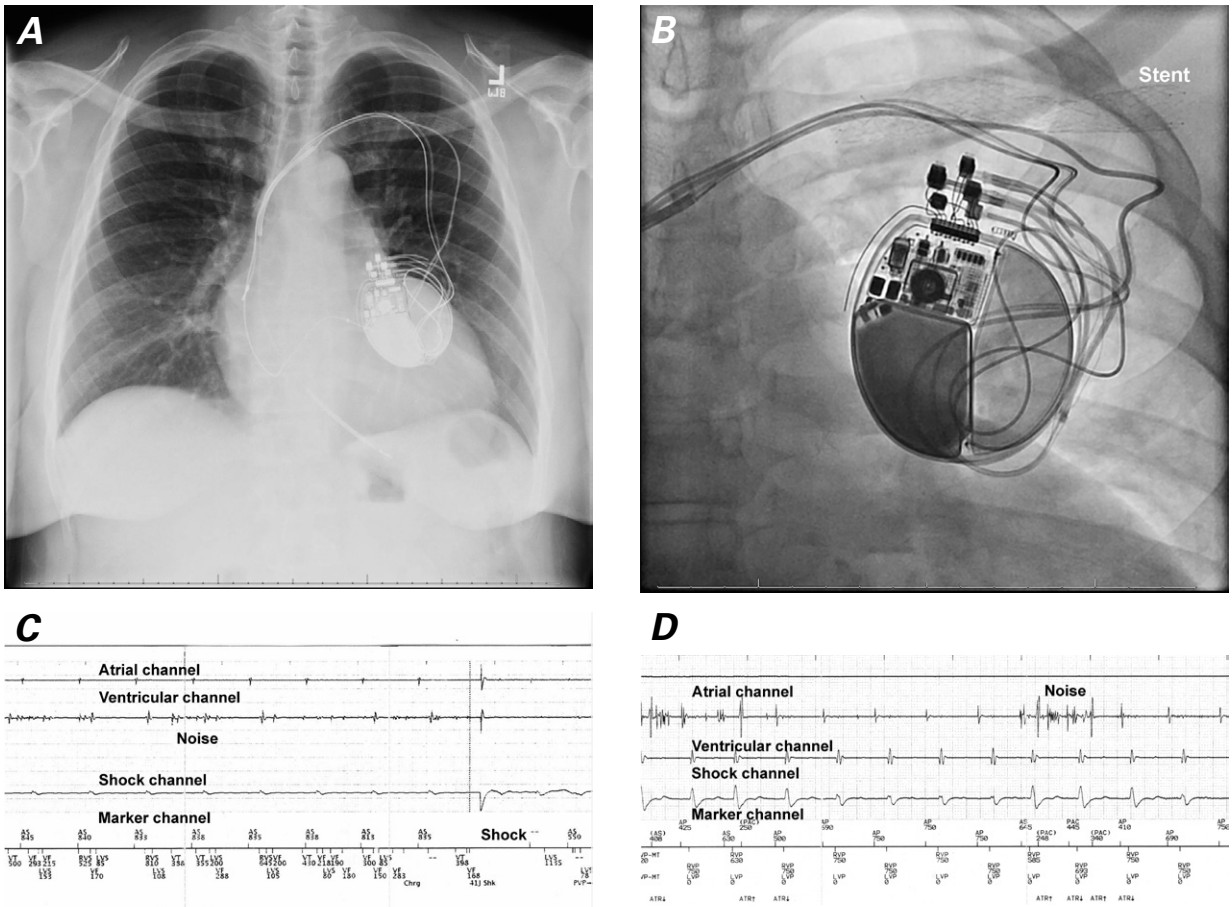

Fig. 1 ***A****) Chest radiograph shows the implanted left prepectoral cardiac resynchronization therapy defibrillator.* ***B****) Fluoroscopic image shows the stent across the device leads.* ***C****) Intracardiac tracings reveal noise in the right ventricular channel, detected as ventricular tachycardia and fibrillation, followed by inappropriate shock.* ***D****) Intracardiac tracings reveal noise in the right atrial and right ventricular channels, reproduced by means of isometric exercise.*

In April 2015, the patient had a cardiac arrest while undergoing hemodialysis at home. He was found to be in ventricular fibrillation and was successfully defibrillated and intubated. However, he sustained profound hypoxic ischemic encephalopathy with minimal neurologic recovery. His family placed him in a long-term care facility on ventilator support, with a tracheostomy and feeding tube.

Discussion

A rare sequela of pacemaker placement is superior vena cava syndrome (SVCS) caused by subsequent thrombosis, fibrosis, or both. The reported prevalence of this phenomenon ranges from 1 in 250 to 1 in 40,000 persons. In 104 patients whose pacemaker-related SVCS was treated by various medical and surgical means, surgery and stenting appeared to be more effective than anticoagulation and thrombolysis. Stenting was most often used to treat pacemaker-related SVCS; the device leads were retained or jailed in 72% of cases, without reported sequelae during a short follow-up period.[5]

Central vein stenosis is another sequela of CRT-D lead-placement through the subclavian vein ipsilateral to AV access for hemodialysis. Saad and associates[6] reviewed the cases of 14 hemodialysis patients with symptomatic central vein stenosis who had CRT-D leads thus placed. These patients were treated by means of angioplasty, stenting, or both. No device or lead failure occurred, no deaths were attributable to arrhythmias, and no patient needed device removal or exchange.[6]

Baranowski and co-authors[7] described the case of an 86-year-old patient who had a left-sided, dual-chamber pacemaker and ipsilateral AV access for hemodialysis. During lead revision after device failure, the previous leads were capped. Subsequent left subclavian vein occlusion led to AV-access failure, venoplasty, and stenting of that vein, whereupon the 4 device leads impinged upon the vein wall or were trapped against it by the stent. After eventual lead fracture and malfunction, the patient underwent CRT pacemaker implantation through right axillary access.[7]

Whereas Saad and colleagues[6] reported no short-term device sequelae after stenting, long-term safety data are

lacking. The practice of jailing the leads raises concern about subsequent compromise of lead integrity and function, and it makes dealing with infection more difficult if lead extraction becomes necessary.

The current expert consensus is to extract transvenous leads before stenting, to avoid their entrapment.[8] Our patient's inappropriate shock and the electrical sensations in his left arm were probably caused by damage of the lead insulation by the stent. Had the declotting procedure been planned in collaboration with an electrophysiologist, these sequelae might have been avoided. In the end, our psychologically traumatized patient insisted upon ICD removal—an act that deprived him of the timely benefits of defibrillation—and he sustained profound brain damage before he could be defibrillated for ventricular fibrillation.

To our knowledge, ours is the first report wherein jailed CRT-D leads resulted in lead damage and inappropriate ICD shock in a patient with nonischemic cardiomyopathy and end-stage renal disease.

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