

## Case report

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# A hybrid ICD extraction approach using laser and transfemoral extraction technique

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Indications for pacemaker and implantable cardioverter defibrillator (ICD) implantations are rapidly expanding. Hence, device-related complications have increased the need for lead extraction. Lead extractions are performed percutaneously or by open surgery.

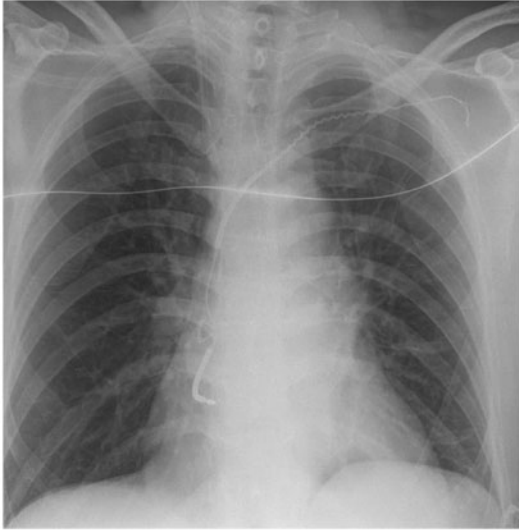
We present a patient with isolated left ventricular noncompaction cardiomyopathy suffering from ICD pulse generator pocket and lead infection with *aggregatibacter actinomycetem comitans* bacteremia. The complete device was successfully removed by a hybrid two-step approach using excimer laser and transfemoral lead extraction technique in combination with mechanical traction via the subclavian vein. Thereby, open surgery with possible need for cardiopulmonary bypass could be avoided in this patient.

### Case presentation

A 55-year-old male was referred to the hospital due to exertional dyspnea, fatigue and pain in the ICD pulse generator pocket. ICD implantation was performed due to sustained ventricular tachycardia in isolated left ventricular noncompaction cardiomyopathy 10 years ago. ICD pulse generator was replaced due to battery depletion 3 years ago. On admission, the patient was hemodynamically stable, and the ICD pulse generator pocket was reddened and swollen. Laboratory chemistry revealed slightly elevated C-reactive protein levels (22 mg/l). No intracardiac vegetations were visualized by transesophageal echocardiography, left

ventricular noncompaction was documented with a left ventricular ejection fraction of 51%. Coronary computed tomography revealed normal coronary arteries. The ICD pulse generator pocket was punctured and purulent material could be aspirated. Hence, diagnosis of ICD pulse generator pocket infection with possible lead infection was made. Tissue debridement, and extraction of the ICD pulse generator, the atrial lead and the distal part of the ventricular lead insulation were performed with excimer laser-assisted extraction technique in the operating room 3 days after admission. However, the ventricular lead, the proximal part of the insulation and the conductor coil could not be removed and were left in place (Figure 1). Postoperatively, antibiotic therapy with vancomycin and ciprofloxacin was administered. The ventricular lead with its insulation and the conductor coil were extracted in the cardiac catheter laboratory 4 days later. Both, the ventricular lead and its insulation were removed by transfemoral venous access under fluoroscopy using a DRS-100 basket (COOK Medical Inc., Bloomington, IN, USA) as retriever device. Having inserted an eight French femoral sheath, the preloaded basket retriever device was advanced to the heart and opened to grab the ventricular lead with its insulation. After grasping the lead, the basket was closed to fix the lead and traction was applied to pull it from the heart to the inferior vena cava and remove it from circulation (Figure 2). The lead was pulled out with the sheath through a small cutaneous incision, the vein was compressed manually for five minutes and definite

hemostasis was completed by a cutaneous Z-suture. The ingrown conductor coil was unwinded via the subclavian vein by mechanical traction with a clamp through the surgically reopened ICD pulse



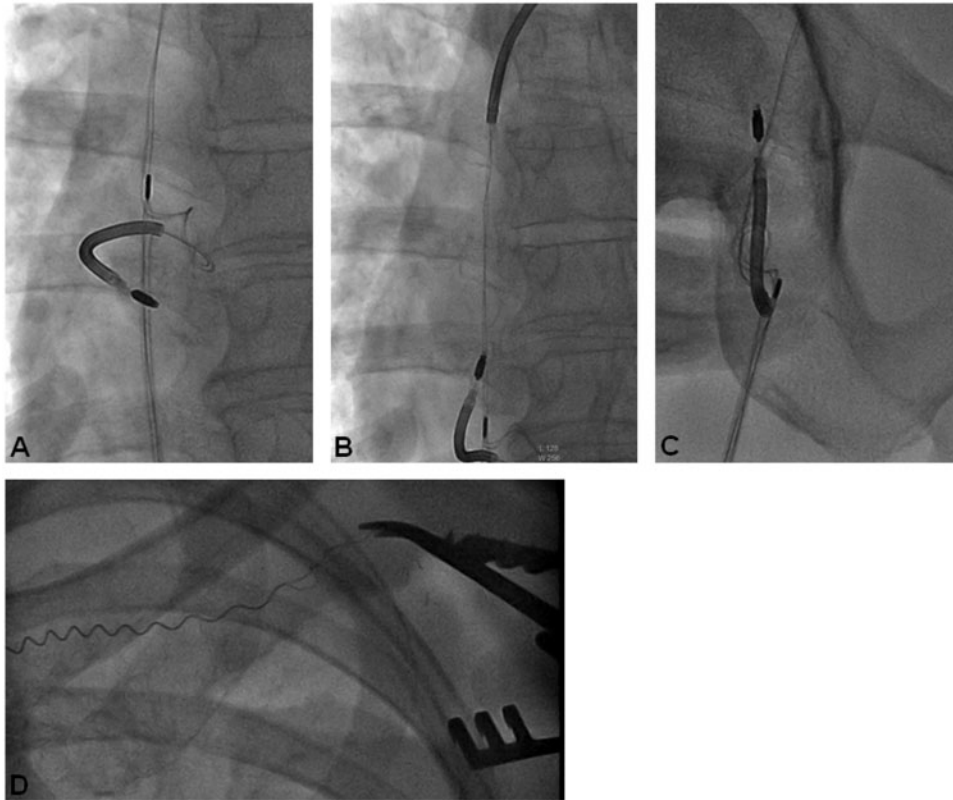
**Figure 1.** Chest X-ray with ventricular lead, lead insulation and conductor coil left in place.

generator pocket after coil location under fluoroscopic visualization (Figure 2D). Hence, both the ventricular lead with its insulation and the conductor coil, could successfully be removed (Figure 3), and open surgery with possible need for cardiopulmonary bypass could be avoided in this patient. In the course, *aggregatibacter actinomycetem comitans* was isolated from several blood cultures, the material obtained by puncture of the ICD pulse generator pocket, and the extracted device and antibiotic therapy was changed to ceftriaxone.

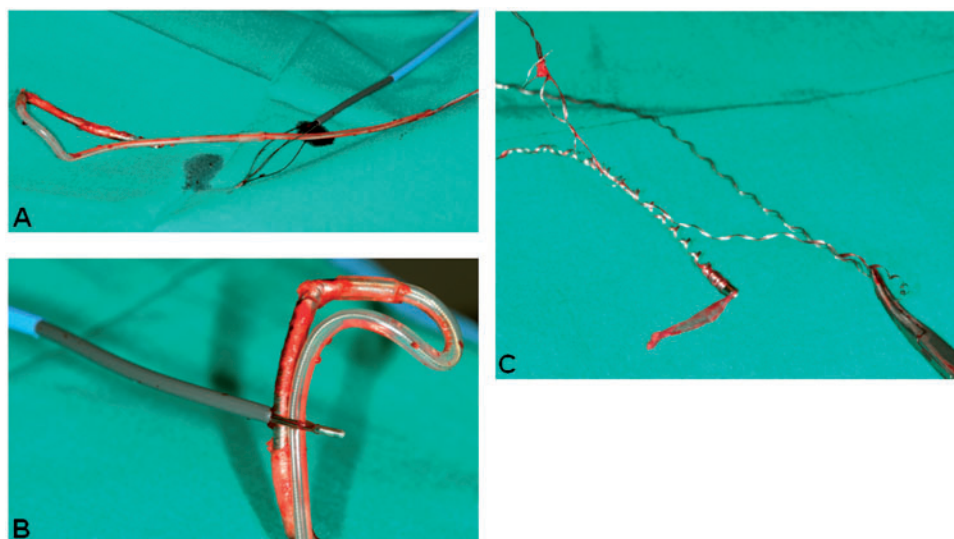
In the course, elevated C-reactive protein levels normalized and the patient fully recovered and could be discharged 10 days after admission. One month after lead extraction, a new ICD was successfully implanted.

## Comment

We describe the first case of a two-step hybrid ICD lead extraction approach using excimer laser and transfemoral extraction technique in combination with mechanical unwinding of the ingrown conductor coil via the subclavian vein.



**Figure 2.** Extraction sequences of ventricular transfemoral lead removal with a retriever basket. (A and B) Retriever basket removing the grasped lead from the heart to the inferior vena cava. (C) Retriever basket with the grasped lead in the iliacal vein. (D) Unwinding of the conductor coil via the subclavian vein by mechanical traction.



**Figure 3.** (A) Open retriever basket with removed ICD lead and fibrous adhesions. (B) Closed retriever basket with removed ICD lead and fibrous adhesions. (C) Removed conductor coil of the ventricular lead with fibrous adhesions.

Pacemaker and ICD implantation rates have rapidly been increasing over the past decades. In the course, increased device-related complications have raised the need for device removal. Device-associated infections are the commonest indication for complete device removal having been reported in 0.9–19.9% of patients.<sup>1</sup> Further indications for device removal are risk of lead fracture, chronic pain, thromboembolic events associated with thrombus material attached to the lead and life-threatening arrhythmias secondary to lead dysfunction.<sup>2</sup>

Lead extraction is performed either by an open surgical or a percutaneous approach using different removing systems such as electrocautery dissection sheaths, excimer laser or transfemoral extraction devices. Manual or mechanical traction is often sufficient to remove leads implanted a few months ago; however, due to fibrous attachment to surrounding structures, advanced extraction devices are used for removal of devices that have been implanted for years. Percutaneous technique is favored above open surgery because of its lower morbidity and mortality. Indeed, most leads can completely be removed percutaneously, success rates of 88–97% have been reported.<sup>3</sup> However, open surgery has to be discussed in patients presenting with large lead vegetations and tricuspid valve vegetations due to the substantial risk of embolization. Furthermore, open surgery is required if complete percutaneous removal has failed in patients with systemic device-related infections. Predictors of major procedural complications are long implantation time, female gender, ICD lead removal and the use of

laser extraction techniques.<sup>2</sup> Interestingly, elevated preprocedural C-reactive protein levels have been associated with increased acute in-hospital mortality.<sup>4</sup>

Apart from the venous entry site, both, the jugular and the femoral vein, can be used to gain venous access for percutaneous lead removal. Different femoral extraction devices such as deflecting wires, dotter retrievers and wire loop snares have been described.<sup>5</sup> One of the earliest transfemoral lead extraction was performed using a pigtail catheter to grab the lead and pull it into the inferior vena cava, where it was snared with a dotter retriever and removed from circulation.<sup>6</sup> In our patient, an eight French basket retriever was used for extraction of the ventricular lead.

Hence, hybrid approaches using different percutaneous lead extraction systems such as excimer laser and transfemoral extraction devices, possibly combined with manual or mechanical traction via the subclavian vein, as with our patient, can safely be performed and may avoid the need for open surgery.

*Conflict of interest:* None declared.

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