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A Challenging Case of Transvenous Lead Extraction Using a Mechanical Dilator Sheath via Combined Subclavian and Femoral Vein Approaches

Kombine Subklavyen ve Femoral Ven Yaklaşımları ile Mekanik Dilatör Kılıfı Kullanılarak Zorlu Transvenöz Elektrot Çıkarma İşlemi Vakası

CASE IMAGE
OLGU GÖRÜNTÜSÜ

A 26-year-old male patient presented to the emergency department with complaints of palpitations followed by fainting. His medical history included aortic coarctation surgery in 1996, mitral valve replacement surgery in 2005, and left pectoral implantable cardioverter-defibrillator (ICD) implantation in 2010 following cardiac arrest. Additionally, a new dual-coil single-chamber ventricular demand pacing implantable cardioverter-defibrillator (VVI-ICD) was implanted in the right pectoral region in 2011, leaving the previously implanted lead in place due to a lead fracture (Figure 1A). He also underwent atrial tachycardia ablation in 2021 and 2022. His vital signs were stable at presentation. Electrocardiography (ECG) showed sinus rhythm (77 bpm). Echocardiography revealed a left ventricular ejection fraction (LVEF) of 35%, normal mechanical mitral valve function, moderate tricuspid regurgitation, and a systolic pulmonary artery pressure (sPAP) of 50 mmHg. ICD interrogation revealed a battery life of 2.94 V (elective replacement indicator [ERI]: 2.63 V), basal rate of 50 bpm, ventricular tachycardia (VT)/ventricular fibrillation (VF) zones at 162/194 bpm, ventricular lead pacing amplitude of 2.0 V, ventricular lead sensing amplitude of 14.8 mV, pacing impedance of 625 ohms, pacing threshold of 1.0 V, and shock impedance of 33/59 ohms. It was observed that the patient had regular tachycardia with altered intracardiac ventricular signal morphology at a rate of 231 bpm. However, despite the ICD detecting the tachycardia and indicating a shock signal, the patient did not receive any therapy (marked as OJ, with a warning for shock impedance of < 20 ohms). Considering the possibility of high-voltage coil insulation breach, implantation of a new ICD system (both lead and battery) was planned after transvenous lead extraction (TLE). Extraction of the first ICD lead, implanted 12 years earlier via the left subclavian vein, was not considered. Upper extremity venography prior to the procedure revealed venous occlusion at the right subclavian vein level. A dual-coil ICD electrode, implanted 11 years ago in the right pectoral region, was released from the battery pocket. Removal was attempted using an EZ1 locking stylet and a 13F TightRail (Spectranetics, Philips) mechanical dilator sheath (Figure 1B). However, this was unsuccessful, and the electrode fractured. The broken proximal end of the electrode was captured. Using a BullDog Lead Extender (Cook Medical), the 13F TightRail mechanical dilator sheath was advanced over the electrode to the tip, but the electrode could not be removed (Figure 1C-E). A 20F short sheath was then placed in the femoral vein. A direct femoral snare-only attempt was performed after capturing the fractured lead tip in the inferior vena cava (IVC). However, due to firm adhesions along the lead body and coil, retrieval could not be completed using the snare alone. The tip of the ICD electrode was then pulled distally from the IVC using a Marinr radiofrequency (RF) ablation catheter and a 20-mm standard GooseNeck snare (Figure 1F-G). The ICD lead was then successfully and uneventfully removed from the femoral tract using a 13F TightRail mechanical dilator sheath over the snare (Figure 1H-J, Supplementary Video 1). Left-sided non-selective (Figure 1K) and selective (Figure 1L) venography revealed venous occlusion at both the subclavian and brachiocephalic vein levels. A new ICD lead was therefore placed via the right subclavian vein in a separate session (Figure 2).

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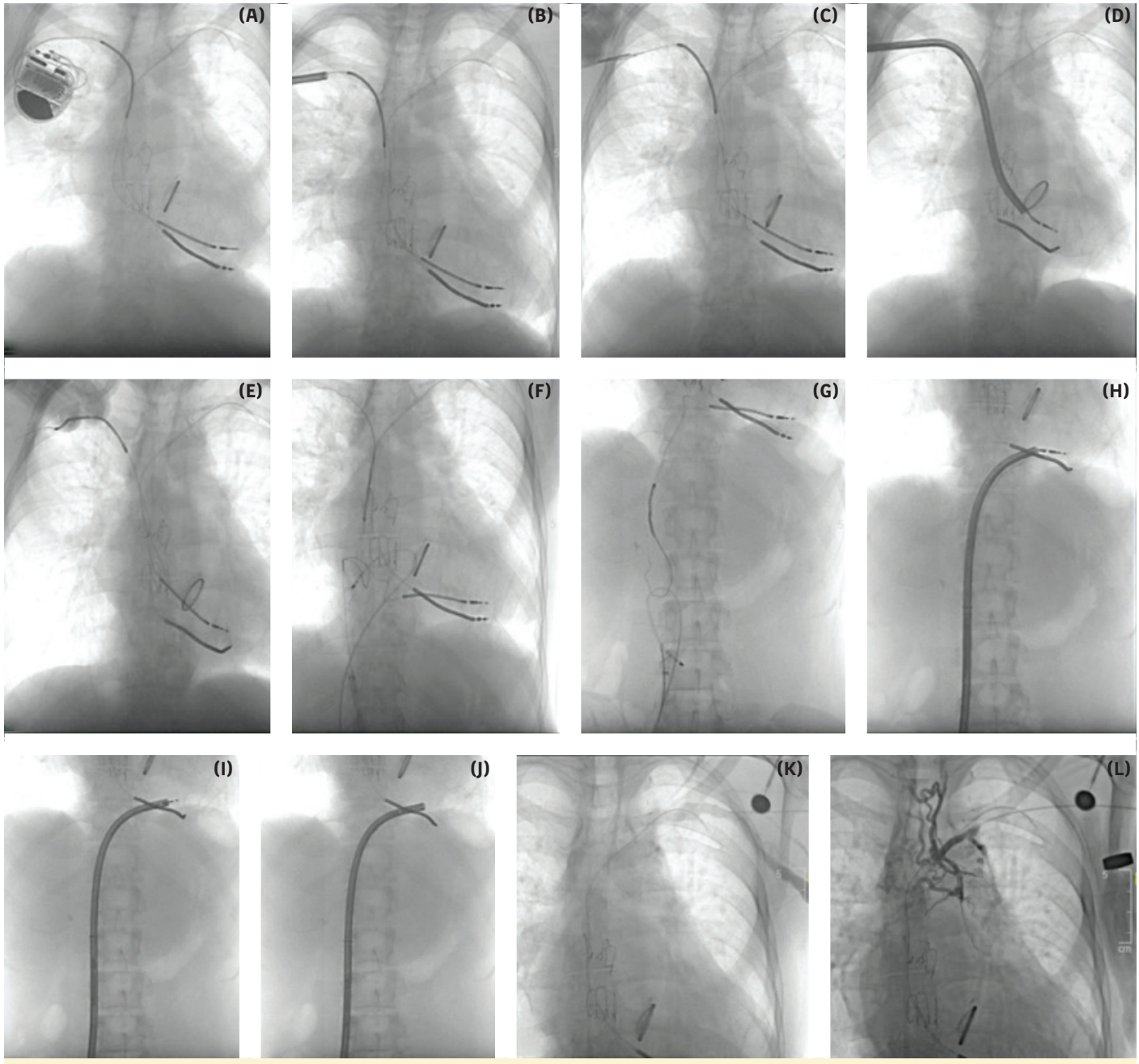

Figure 1. (A) The figure shows a right-sided dual-coil ventricular demand pacing with implantable cardioverter-defibrillator (VVI-ICD) lead and an abandoned left-sided single-coil VVI-ICD lead. (B) A 13F TightRail mechanical dilator sheath was used with the help of an EZ1 locking stylet from the subclavian access. (C-D-E) The lead was fractured, and the BullDog Lead Extender was used as a novel railway for the mechanical dilator sheath. The railway was fractured, and the procedure failed from the subclavian access. (F-G) The tip of the ICD electrode was pulled distally from the inferior vena cava (IVC) using a Marinr radiofrequency (RF) ablation catheter and a 20-mm standard GooseNeck snare. (H-I-J) The ICD lead was then successfully and uneventfully removed from the femoral tract using a 13F TightRail mechanical dilator sheath over the snare. Left-sided non-selective (K) and selective (L) venography also revealed venous occlusion at the subclavian and brachiocephalic vein levels.

Femoral extraction of transvenous leads using snares and large sheaths is a well-documented strategy, often employed when subclavian approaches fail. Previous reports have highlighted the utility of femoral snares in complex cases. However, to our knowledge, advancement of a mechanical dilator sheath via the femoral route to achieve successful extraction has been rarely described. This technique provided a unique alternative when both subclavian dissection and snare-only femoral attempts were unsuccessful. In situations with multiple challenging factors, as in our patient, such as young age, longer dwell time, dual-coil ICD leads, venous occlusion, and prior abandoned leads, the ability to use the TightRail sheath femorally may represent an important addition to the extraction toolkit. Therefore, an additional femoral approach

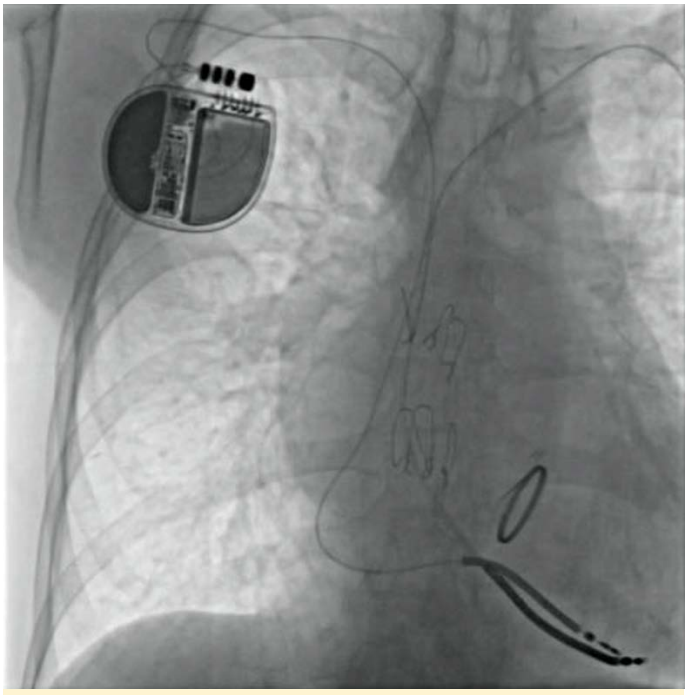

Figure 2. The figure shows the new right-sided implantable cardioverter-defibrillator (ICD) lead implantation.

was required, and we demonstrated that the mechanical dilator sheath can also be used successfully via the femoral approach, not only snares or telescoping sheaths as described in most previous reports. We propose that the success of this approach is not solely due to the greater exerted force, but rather to the altered traction vector achieved by the femoral route, which provides more favorable alignment along the lead body and reduces counterforces at adhesion sites. This vector advantage, combined with the sheath's ability to dissect fibrotic adhesions, facilitated complete removal.

Ethics Committee Approval: This is a single case image, and therefore ethics committee approval was not required in accordance with institutional policies.

Informed Consent: Written and verbal informed consent was obtained from the patient.

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Video 1. The video displays all details of the transvenous lead extraction (TLE) procedure.