

A 20-year indwelling dual-coil passive-fixation ICD lead complicated by CIED pocket infection in an 85-year-old patient: a rare case report

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Case Report

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Abstract

Background Complete removal of the cardiovascular implantable electronic device (CIED) system is the only curative treatment for CIED pocket infection. Advanced age and prolonged lead dwell time significantly increase the risks of transvenous lead extraction (TLE). However, reports of TLE in patients over 85 years with leads indwelling for two decades are exceedingly rare.

Case presentation We report an 85-year-old man with a dual-coil passive-fixation implantable cardioverter-defibrillator (ICD) lead implanted 20 years prior, who presented with CIED pocket infection. Intraoperatively, occlusion of the mid-to-distal lead lumen was encountered during locking stylet advancement, precluding laser sheath extraction. An 11-F TightRail™ rotational mechanical dilator sheath was therefore used to dissect dense fibrotic tissue surrounding the lead in a layer-by-layer fashion, enabling complete lead extraction. After one week of antimicrobial therapy, a subcutaneous implantable cardioverter-defibrillator (S-ICD) was implanted due to persistent high risk of malignant ventricular arrhythmias and the risk of recurrent pocket infection associated with transvenous lead reimplantation.

Conclusions This case represents a rare clinical scenario of TLE in an octogenarian with a 20-year indwelling dual-coil passive lead and multiple comorbidities. The successful outcome underscores the importance of meticulous preoperative risk stratification, multidisciplinary collaboration, and individualized procedural strategies for such high-risk patients.

Background

Implantation volumes of CIEDs continue to increase, and the incidence of device-related infectious complications has risen accordingly. Guidelines recommend complete removal of the pulse generator and all leads as the only curative approach once a CIED infection is confirmed, since isolated pocket debridement is associated with an infection recurrence rate exceeding 40% [1–2]. Procedural risk during transvenous lead extraction (TLE) is strongly correlated with lead implantation duration, lead design characteristics, and patient age [3]. Lead dwell time is an established independent risk factor for severe vascular and myocardial fibrocalcific adhesions; leads with dwell times exceeding 15 years are considered high-risk, with each additional implantation year conferring an incremental 16% risk of severe adhesions and life-threatening intraoperative complications [4]. Advanced age and multiple comorbidities further worsen peri-procedural risk, as vessel fragility may reduce the likelihood of successful rescue should major vascular laceration or cardiac tamponade occur [5, 6]. Passive-fixation ICD leads with dual-coil configurations tend to induce pronounced chronic fibroplasia and deep trabecular entrapment, which substantially augment extraction difficulty [7, 8]. Despite these well-recognized risk factors, a dual-coil passive-fixation ICD lead indwelling for two decades complicated by CIED pocket infection in an 85-year-old patient combines several independent high-risk features within a single patient and is rarely encountered; such a scenario has seldom been reported and merits documentation. Laser sheath extraction is widely used for leads complicated by dense adhesions, yet it

requires a locking stylet to traverse the full lead lumen to establish a stable coaxial fulcrum; luminal obstruction prohibits proper stylet positioning, and forced laser sheath advancement under these circumstances risks eccentric cutting and great-vessel injury [9]. We describe here the clinical features and management challenges of this rare case.

Case Report

An 85-year-old male was admitted in April 2026 for spontaneous ICD pocket rupture with drainage. Conservative management with local disinfection and dressing changes yielded no improvement, and he was readmitted in June 2026 for definitive treatment. His medical history included coronary artery bypass grafting (CABG) 23 years earlier, hypertension for 30 years, chronic kidney disease for 10 years, and cerebral infarction with aphasia one year earlier. In December 2023, blisters developed over the chest wall device pocket with intermittent pale-yellow drainage; pocket debridement was performed at our institution, and the wound healed satisfactorily postoperatively. Physical examination revealed afebrile status and normal cardiopulmonary auscultation. Cutaneous rupture with visible drainage was noted at the left infraclavicular device pocket (Fig. 1A). Laboratory tests showed a normal complete blood count and normal procalcitonin and interleukin-6 levels. A 72-hour bacterial culture of pocket drainage and serial blood cultures were negative. Electrocardiography demonstrated sinus rhythm with nonspecific T-wave abnormalities. Transthoracic echocardiography revealed left ventricular enlargement, segmental wall motion abnormalities, an inferoposterior left ventricular aneurysm, mild tricuspid regurgitation, and a left ventricular ejection fraction of 35%, without intracardiac vegetations. Chest radiography confirmed appropriate positioning of the generator and leads. Device interrogation showed stable lead electrical parameters. Admission diagnoses: ischemic cardiomyopathy, NYHA functional class III, ventricular tachycardia, status post ICD implantation, CIED pocket infection.

The patient received single-chamber ICD implantation in June 2006 for hemodynamically unstable ventricular tachycardia (VT) with syncope after CABG, a presentation that met secondary prevention criteria, using a St. Jude Medical EPIC + VR Mode 1 V196 generator together with a Riata 1570 defibrillation lead. The pulse generator was replaced in October 2013 (St. Jude Medical VR-1107) and again in May 2023 (Medtronic DVMD3D1) due to battery depletion, while the original Riata lead was preserved with stable electrical parameters. One year after the initial implantation, recurrent monomorphic VT refractory to antiarrhythmic medications and anti-tachycardia pacing (ATP) was terminated by an appropriate ICD shock, preventing sudden cardiac death. Device programming was subsequently optimized: the VT detection rate was raised from 170 to 188 beats/min, the number of intervals to detect was increased to 30/40 cycles, and three bursts of ATP were programmed for the slow VT zone prior to shock delivery in the ventricular fibrillation (VF) zone. Over the 20-year follow-up, there were no inappropriate shocks, no aborted sudden cardiac death, and no requirement for bradycardia pacing; the pacing burden remained near zero.

Following multidisciplinary consultation with cardiology, cardiac surgery, anesthesiology, and echocardiography, written informed consent was obtained from the patient and his family. Transvenous

lead extraction with pocket debridement was performed on June 26, 2026.

The patient was placed in the supine position under general endotracheal anesthesia. A temporary pacemaker was placed via the femoral vein for intraoperative hemodynamic support (Fig. 1B). An additional femoral venous sheath was retained as alternative inferior vena caval access for lead extraction if required. Intraoperative transesophageal echocardiography (TEE) was continuously employed to monitor cardiac function and pericardial status, with a cardiac surgical team on standby. A skin incision was made 1.5 cm inferior to the left clavicle, followed by pocket debridement to remove devitalized tissues for microbial culture. The lead was dissected from surrounding tissues to the venous entry site.

A locking stylet model 518 – 067 (Spectranetics) was initially planned for advancement through the lead lumen to the tip for stabilization before laser sheath adhesion dissection. However, the locking stylet could only be advanced to the left subclavian-superior vena caval junction and failed to reach the tip. Repeated attempts with a probe were similarly unsuccessful (Fig. 1C). Given occlusion and damage to the mid-to-distal inner lead lumen, as well as severe adhesions between the lead and the vessel wall and myocardium, the locking stylet could not be anchored to the lead tip, and the laser sheath approach was abandoned. An 11-F TightRail™ rotating dilator sheath (Spectranetics Corporation) was used instead. The sheath was advanced over the lead while maintaining strict coaxial alignment with continuous countertraction on the lead body (Fig. 1D). The retractable rotational cutting blade at the tip of inner sheath dissected layered fibrocalcific adhesions encasing the lead (Fig. 1E). Alternating dilation with the rotating inner sheath and rigid outer sheath was performed with slow incremental advancement, and these dissection maneuvers were repeated segmentally along the lead course (Fig. 1F). With controlled traction, the lead was extracted without retained fragments (Fig. 1G). Grossly, the lead was encapsulated by fibrotic tissue (Fig. 2A). Vital signs remained stable throughout the 2.5-hour procedure. Intraoperative TEE revealed no pericardial effusion or valvular abnormalities (Fig. 2B). Total fluoroscopic radiation exposure amounted to 500 mGy·cm². All sheaths were removed uneventfully, and the patient was transferred to the CCU for 24-hour monitoring. Both the patient's blood cultures and secretion cultures were negative. Preoperatively, cefuroxime was administered as anti-infective therapy, and the treatment was continued for one week after surgery. Follow-up tests revealed normal routine blood results and negative blood cultures.

Multidisciplinary team consultation and shared decision-making with the family reassessed the indication for ICD reimplantation. The patient had persistently reduced LVEF ($\leq 35\%$) over two decades, a history of ATP-refractory hemodynamically unstable monomorphic VT requiring shock termination, estimated survival exceeding 1 year, and a higher competing risk of arrhythmic versus non-arrhythmic death given comorbidities. S-ICD was favored over transvenous ICD for three reasons. First, the patient had no pacing dependency (near-zero burden), a narrow QRS (114 ms) without cardiac resynchronization therapy (CRT) indication, and preoperative S-ICD ECG screening confirmed adequate vectors for reliable VT/VF discrimination. Second, transvenous ATP offered limited long-term control of recurrent scar-related monomorphic VT, which consistently required high-energy shocks for acute termination. Third,

prior cutaneous rupture and failed debridement conferred an extremely high risk of recurrent pocket infection; S-ICD eliminates intravascular leads, thereby avoiding venous adhesion, insulation damage, and lead-related pocket infection. Following one week of anti-infective therapy after lead extraction, S-ICD (model A209, Boston Scientific) implantation was performed (Fig. 2C). The patient had stable vital signs and satisfactory wound healing, and was discharged five days after subcutaneous ICD implantation. At three-month outpatient follow-up, the surgical incision had healed completely without signs of infection; device interrogation revealed stable electrical parameters; no ventricular arrhythmia was documented, with no deterioration in cardiac function. The timeline of hospital management is summarized in Fig. 3.

Discussion and conclusions

The incidence of CIED infections has been increasing annually, with a global infection rate ranging from 0.8% to 4.2% [10]. The present case is remarkable primarily for its rarity: an 85-year-old patient with a dual-coil passive-fixation ICD lead that had remained indwelling for 20 years, complicated by CIED pocket infection. This combination brings together several independent high-risk features—prolonged lead dwell time [4], a dual-coil passive-fixation design, and advanced age with multiple comorbidities—within a single patient, a scenario seldom described in the literature. The 20-year indwelling lead exhibited severe fibrocalcific adhesions, evidenced by fluoroscopic calcifications along the subclavian vein and superior vena cava, marked dissection resistance at the subclavian entry, tricuspid annulus, and right ventricular myocardium, and the explanted lead was fully surrounded by thick layered fibrocalcific encapsulation. Traction carried substantial risk of vascular laceration or myocardial perforation, and its dual-coil passive-fixation design promoted chronic fibroplasia and deep trabecular engagement, markedly increasing extraction resistance [11]. The patient's age of 85 years, long-standing hypertension, and history of CABG were associated with fragile vessels and poor cardiac function; in the event of cardiac tamponade or great vessel rupture, the likelihood of successful emergency rescue would be extremely low. In addition, the lead inner core was damaged and occluded, preventing the locking stylet from reaching the lead tip; because laser sheaths require an in situ guidewire for coaxial advancement, forced advancement would risk eccentric cutting and potential superior vena cava injury, rendering the laser sheath approach inapplicable and substantially increasing the technical difficulty of the procedure. The intraoperative mid-to-distal luminal occlusion likely resulted from chronic fibrocalcific compression over 20 years of intravascular dwell time, together with degenerative debris from the aged inner liner. In this rare and high-risk setting, management relied on careful multidisciplinary planning, with a temporary pacemaker as backup, preplaced femoral venous access for alternative inferior vena caval access, continuous intraoperative transesophageal echocardiography [12], and a cardiac surgical team on standby. Given the luminal occlusion, an 11-F TightRail™ rotating mechanical sheath was chosen; its bidirectional rotating blade with an internal retractable design allowed layer-wise dissection of fibrocalcific scar with controlled countertraction, and alternating the inner rotating and outer sheaths permitted sequential release of the calcified adhesions, enabling complete extraction without retained fragments and without major vascular or myocardial injury, consistent with previous favorable reports of

the TightRail™ system [13, 14]. After lead removal, a subcutaneous ICD was implanted rather than a transvenous system, considering the patient's lack of pacing dependency, narrow QRS without cardiac resynchronization therapy indication, the limited long-term control of recurrent scar-related monomorphic VT by transvenous anti-tachycardia pacing, and the high risk of recurrent pocket infection with any retained intravascular hardware. These choices represent one management approach tailored to this patient's specific features rather than a general recommendation, and were achieved with stable intraoperative hemodynamics and no procedure-related complications. This single-case report carries inherent limitations: lead luminal occlusion could not be predicted preoperatively, negative microbiological cultures limited pathogen-directed antibiotic therapy, and follow-up was restricted to three months after S-ICD implantation. Larger series are needed to better characterize this rare clinical entity and to further validate the management approach described.

Abbreviations

CIED☐cardiovascular implantable electronic device

ICD☐implantable cardioverter-defibrillator

S-ICD☐subcutaneous implantable cardioverter-defibrillator

TLE☐Transvenous lead extraction

CABG☐coronary artery bypass grafting

VT☐ventricular tachycardia

ATP☐ anti-tachycardia pacing

VF☐ventricular fibrillation

TEE☐transesophageal echocardiography

CRT☐cardiac resynchronization therapy

Declarations

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Data availability

The datasets used in the case are available from the corresponding author upon reasonable request.

Declaration Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The studies involving human participants were reviewed and approved by Ethics Committee of Wuhan Asia Heart Hospital 2026-B041.

Consent for publication

Consent for publication Written informed consent was obtained from the patient for publication of this case report

YB and LL made contributions to the conception and design of the work, YB writing the manuscript. YB, HWH, LL were participants in the treatment and management of the patient. YB and QQZ made contributions to the image acquisition. YB, QQZ and LL were the major contributors in critical revision of the manuscript. Funding secured by HWH. All authors read and approved the final manuscript.

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Figures

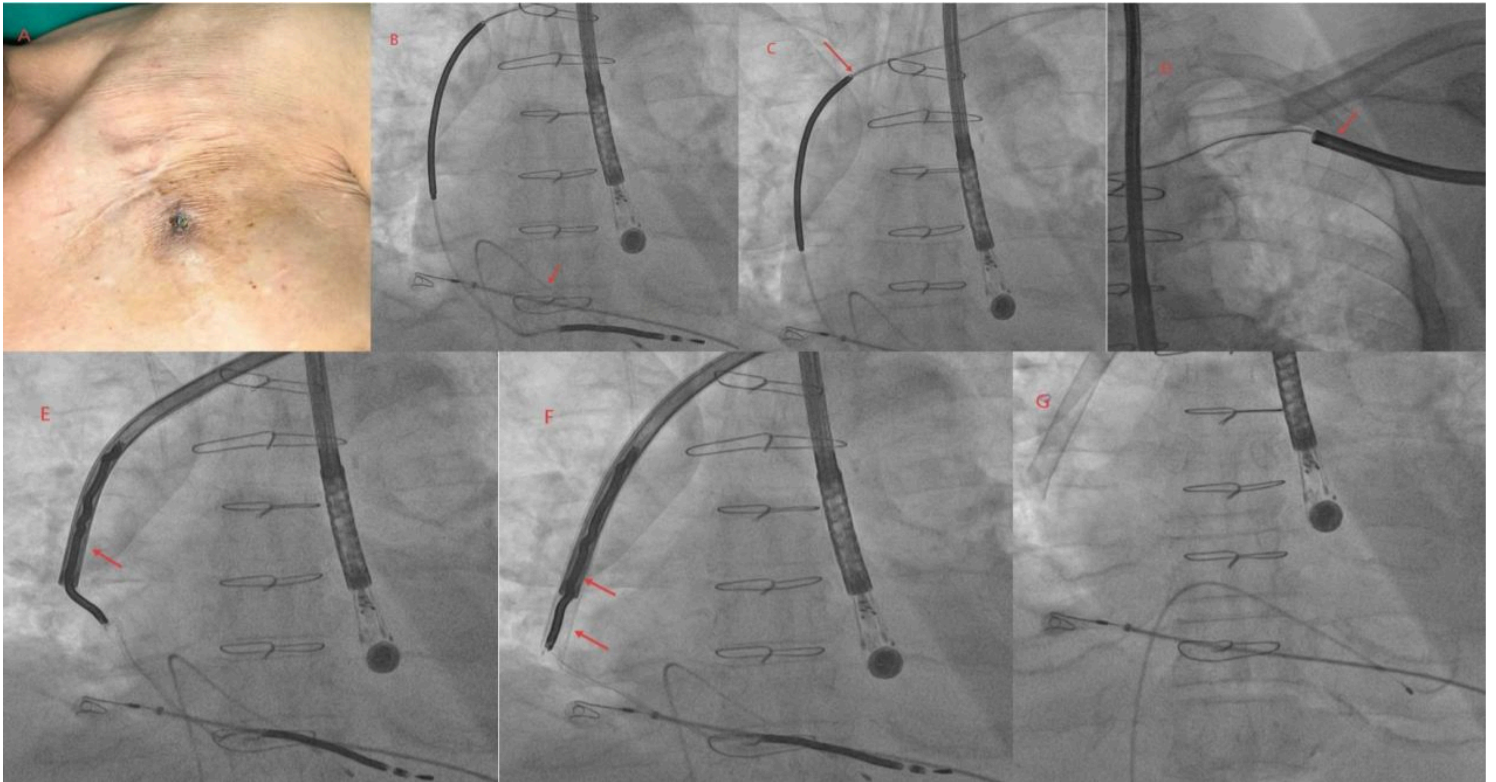


Figure 1

A: ICD pocket skin rupture and exposed lead. B: Placement of temporary pacing lead (arrow). C: Locking stylet only reached the left subclavian-superior vena cava junction. D: Advancement of 11-F TightRail™ rotating dilator sheath coaxially over the lead. E: Rotational blade at the tip of inner sheath dissecting fibrotic adhesions surrounding the lead. F: Alternate dilation with inner and outer sheaths for gradual scar release (arrow). G: Complete extraction of ventricular lead under controlled traction.

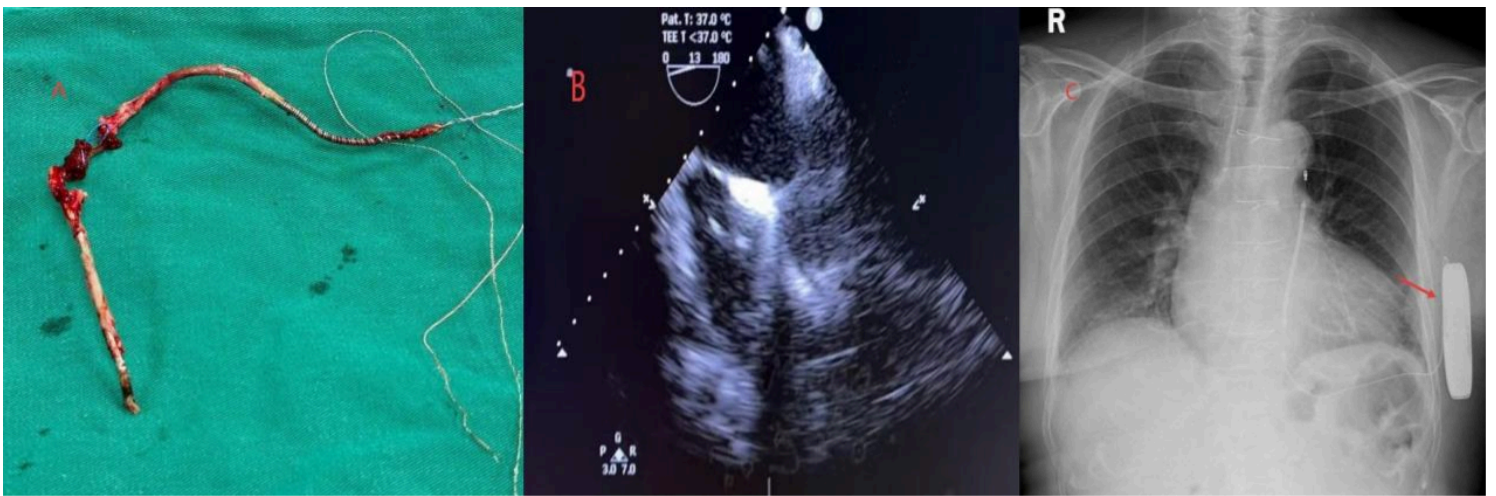


Figure 2

A: Fibrous tissue encapsulation on the explanted lead; B: Intraoperative TEE showing no pericardial effusion or valvular injury; C: Subcutaneous ICD implantation (arrow).

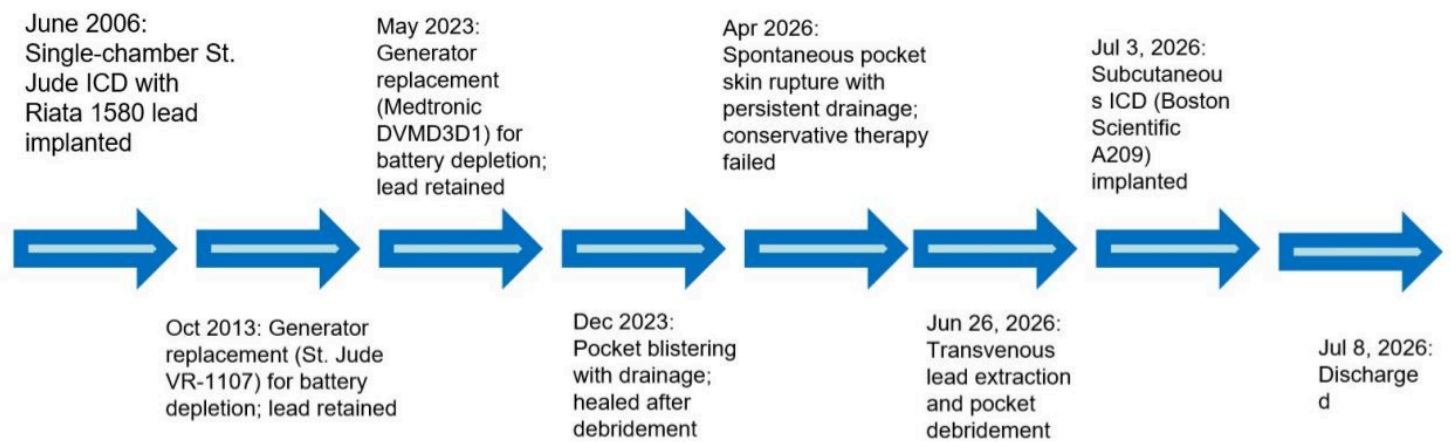


Figure 3

The timeline of hospital management