LETTER TO THE EDITOR

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Transjugular Micra leadless pacemaker implantation complicated by device dislodgement and surgical retrieval: lessons from a rare case



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Leadless pacemakers, such as the Micra Transcatheter Pacing System, have transformed the management of bradyarrhythmias by eliminating the need for transvenous leads and subcutaneous pockets, thereby reducing the risk of infection and lead-related complications [1–3]. Their use is particularly advantageous in patients with recent surgery, malignancy, or immunosuppression, in whom minimizing procedural invasiveness and infection risk is essential [2, 3]. The standard approach for Micra implantation is via the transfemoral route, which has demonstrated favorable long-term safety and performance outcomes [1, 4]. However, in selected patients where femoral access is challenging or contraindicated, alternative access routes such as the internal jugular vein may be considered. Early experience with transjugular Micra implantation suggests that this approach can offer favorable catheter orientation and facilitate septal positioning, yet large-scale data remain limited [5, 6]. Although the safety profile of Micra is favorable, rare complications such as device dislodgement and retrieval difficulties can occur, particularly when non-traditional access routes are employed. In such instances, interdisciplinary collaboration may be essential to ensure successful management and patient recovery [7, 8].

Herein, we report a rare complication during a transjugular Micra implantation, which required open surgical retrieval of the dislodged device from the external iliac vein. The case highlights key technical considerations and underlines the importance of access planning and retrieval strategy when using alternative approaches for leadless pacemaker implantation. An 83-year-old male patient was referred to the cardiology department due to symptomatic bradycardia secondary to slow atrial fibrillation. His medical history was notable for recently diagnosed gastric cancer, for which he had undergone abdominal surgery the day prior to presentation. Given the recent surgical intervention and high risk of infection, the implantation of a leadless pacemaker system was deemed the most appropriate option. To minimize vascular manipulation in the abdominal and pelvic regions, and in light of emerging evidence supporting its feasibility, a transjugular approach was selected. In the Interventional Cardiology Suite, a Micra VR2 leadless pacemaker (Medtronic, MN, USA) was introduced through the right internal jugular vein and advanced into the right atrium. Using the delivery sheath, the device was navigated and successfully positioned at the right ventricular septum, with correct placement confirmed by contrast fluoroscopy. The device was deployed, and a pull-and-hold test demonstrated adequate fixation with two out of four tines engaged. Electrical measurements, including pacing threshold, impedance, and sensing values, were within normal limits.

The next step involved tether removal. Following the standard procedure, the tether limb with higher resistance was cut, and retraction of the remaining tether was initiated. However, increasing resistance was noted during each heartbeat as the tether was gently pulled back. Despite careful handling, the Micra device became dislodged from the ventricular wall and migrated into the right atrium. In response, femoral venous access was obtained to facilitate device retrieval. An EN Snare System (Merit Medical), with an 18–30 mm snare diameter and 120 cm length, was introduced through the Micra delivery sheath. Multiple attempts were made to snare and retrieve the device; however, coaxial alignment with the introducer could not be achieved. The device was repeatedly grasped from the tine end rather

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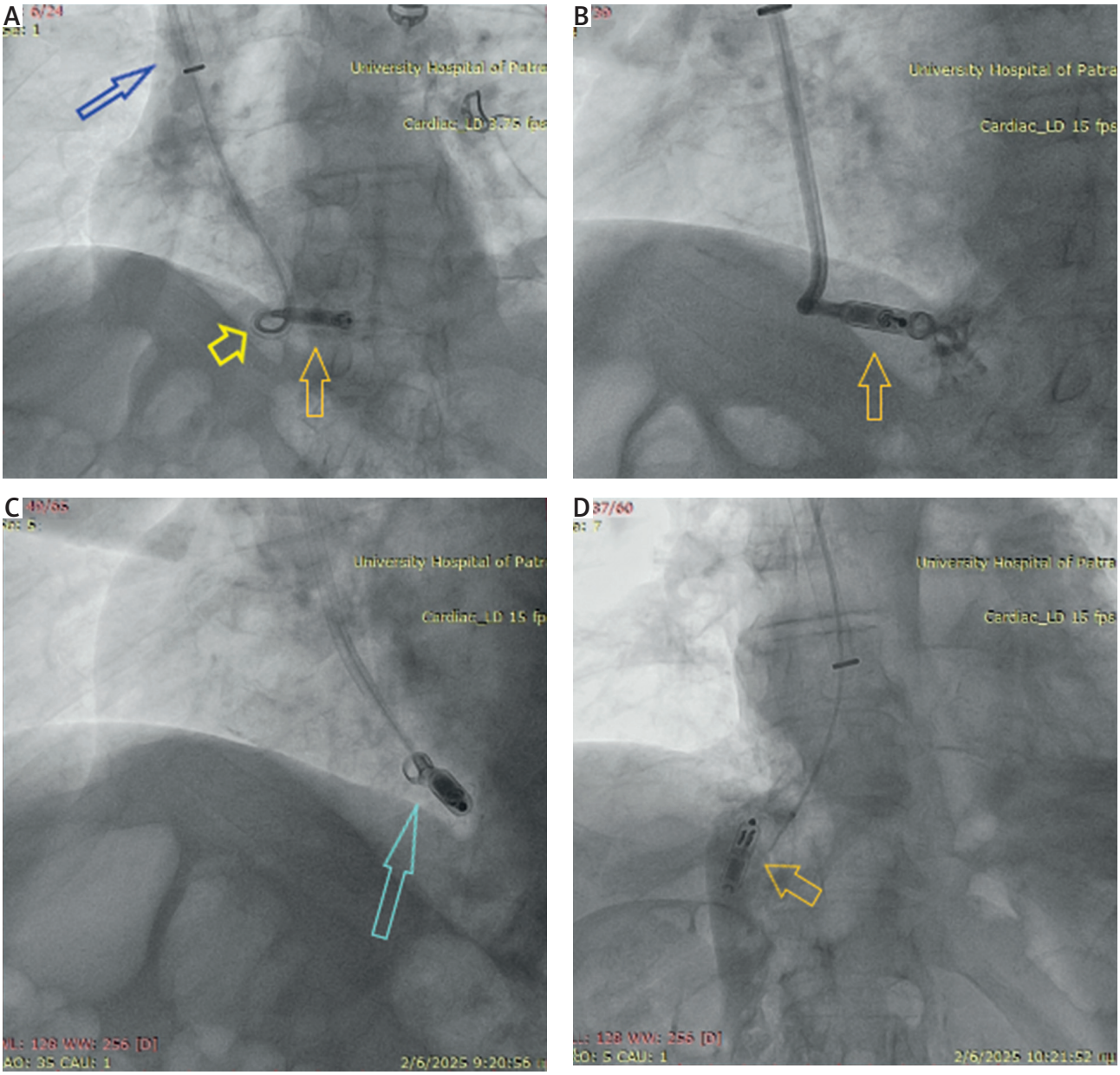


Figure 1. A – Micra landed in the correct position (orange arrow) with clockwise torque but with high tension in the delivery sheath, as indicated by the loop formed (yellow arrow), which ultimately led to unsuccessful advancement of the Micra on the first attempt. **B** – Septal apposition of the Micra before its advancement, as demonstrated by contrast injection. **C** – The Micra was dislodged after the tether had already been cut. An unsuccessful attempt was made to bring back Micra into the delivery sheath (blue arrow). Support was weak as the tether had been cut. **D** – Micra positioned in the inferior vena cava (yellow arrow)

than from the designated retrieval knob. After prolonged manipulation, the pacemaker was eventually withdrawn into the femoral vein but could not be retrieved percutaneously. Consequently, the patient was transferred to the operating room. Under general endotracheal anesthesia, a surgical femoral cut-down was performed. The right common femoral vein (RCFV) was dissected and controlled proximally and distally with vessel loops. Fluoroscopic imaging using a portable C-arm confirmed the location of the device, which had migrated to the external iliac vein (Figure 1). A snare was reintroduced via the RCFV, proximally to the previous entry point, and the device was captured and drawn down into the operative field. Proximal digital compression and traction on the vessel loops were applied to secure the device within the surgical field (Figure 2). A small longitudinal venotomy was performed, and the Micra was retrieved successfully (Figures 3–5). The venotomy was closed with primary suture repair using Gore 7-0 suture, and hemostasis was achieved. The patient had an uneventful postoperative course and made a full recovery.

This case highlights the complex and multifaceted challenges associated with leadless pacemaker implantation via non-traditional venous access. While the Micra Transcatheter Pacing System has demonstrated an excellent

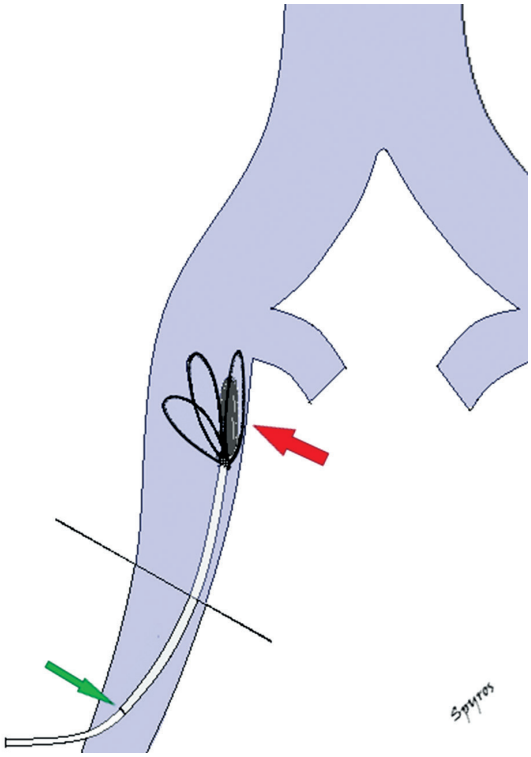


Figure 2. Schematic reconstruction of the fluoroscopic image showing the dislodged Micra leadless pacemaker lodged in the right external iliac vein. A snare system was introduced via the right common femoral vein, which had been surgically exposed through a femoral cut-down. The device was successfully captured using the snare catheter



Figure 5. The extracted Micra leadless pacemaker following successful surgical retrieval

long-term safety and performance profile when implanted through the transfemoral approach [1–4], alternative access strategies such as the internal jugular vein, although

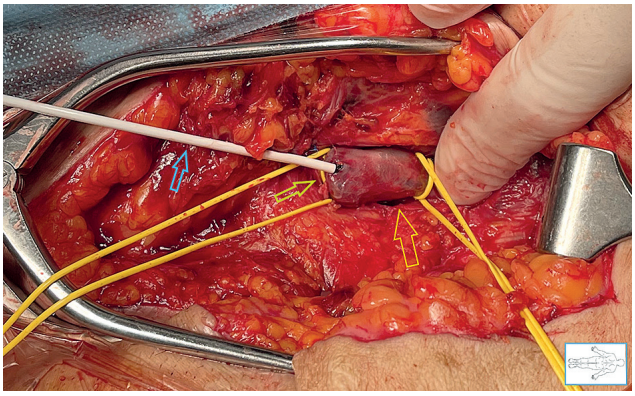


Figure 3. Intraoperative image demonstrating the Micra pacemaker captured by the snare at the level of the right common femoral vein. Digital compression was applied proximally, and gentle traction on the circumferentially placed vessel loops was used to stabilize the device within the surgical field. Yellow arrow: right common femoral vein; green arrow: vascular entry site; blue arrow: snare catheter

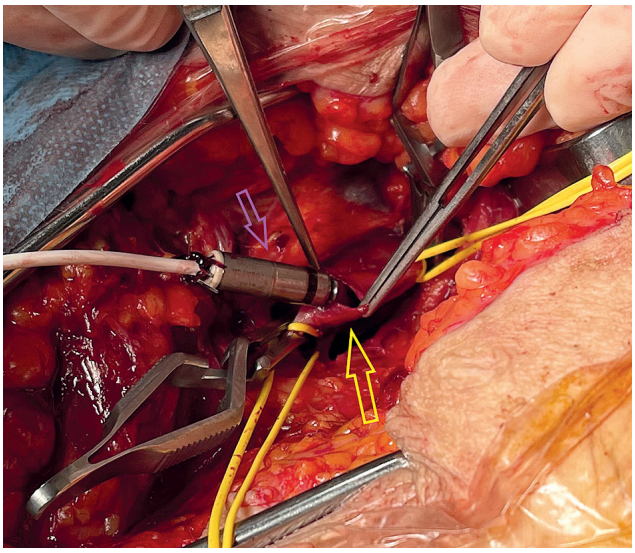


Figure 4. The Micra device was removed through a small longitudinal venotomy after proximal and distal control of the vein using bulldog clamps. Yellow arrow: venotomy; purple arrow: retrieved Micra pacemaker. The venotomy was closed primarily with Gore 7-0 suture

feasible, introduce specific risks that remain underexplored in the literature [5, 6]. In the present case, the transjugular route was chosen due to recent abdominal surgery and gastric malignancy, aiming to reduce infection risk and vascular manipulation in the lower body. Early reports have supported the technical viability of the jugular approach [5, 6]; however, data on complications remain limited. Following a seemingly successful Micra deployment, the device became dislodged during tether retraction, a rare complication with an estimated incidence of less than 1% [7, 9]. The percutaneous retrieval process was complicated by an inability to achieve coaxial alignment and a tendency to capture the device from the tine end instead of the designated retrieval knob.

Transjugular retrieval may be considered in selected cases of device dislodgement following internal jugular implantation. In the present case, although the initial implantation was performed via the transjugular route, percutaneous retrieval from the same access was not feasible due to unfavorable device orientation, loss of coaxial alignment, and repeated engagement of the tines rather than the proximal retrieval feature. These technical limitations significantly reduced the likelihood of successful recapture via the jugular approach and prompted conversion to a femoral strategy, which ultimately also proved unsuccessful and necessitated surgical retrieval [10–13].

Emerging reports suggest that transjugular retrieval of leadless pacemakers may be feasible and, in selected cases, advantageous due to improved alignment with the right ventricular septum and more direct access to the device's retrieval knob. Reddy *et al.* demonstrated in a multicenter experience that percutaneous retrieval of leadless pacemakers is generally safe and effective, although procedural success is highly dependent on device position and operator technique [7]. Similarly, Grubman *et al.* highlighted that retrieval success is influenced by accessibility of the proximal retrieval feature and the ability to maintain coaxial sheath alignment [9]. More recently, Molitor *et al.* described the feasibility of internal jugular access for leadless pacemaker procedures, suggesting that this route may offer technical advantages in selected anatomical scenarios [5].

Additional published experience further supports the concept that alternative venous approaches, including superior access routes, may facilitate both implantation and retrieval in challenging anatomical settings. Kypta *et al.* reported successful implantation and management of leadless pacemaker systems via non-femoral access, emphasizing the importance of individualized vascular strategies in complex patients [14]. Likewise, Garweg *et al.* described early clinical experience with leadless pacemakers and highlighted the feasibility of device retrieval when appropriate snaring techniques and sheath support are achieved [15, 16]. Several reported cases further demonstrated that percutaneous retrieval of leadless devices is highly dependent on procedural planning and imaging guidance, with alternative access routes potentially improving device alignment in selected cases [17–20]. In addition, El-Chami *et al.* reported real-world registry data indicating that while retrieval is uncommon, it is typically successful when performed by experienced operators using appropriate techniques [21].

Furthermore, case-based experiences indicate that advanced snaring strategies, including dual-snare or axis-guided techniques, may enhance the success of complex retrievals and could potentially be adapted to transjugular approaches in the future [13].

Taken together, these findings suggest that while transjugular retrieval was not achievable in the present case due to procedural and anatomical constraints, it may represent a viable alternative in carefully selected patients. Increased operator experience, refinement of retrieval tools, and further accumulation of clinical data may expand the role of transjugular techniques and potentially reduce the need for surgical intervention in similar scenarios.

These and similar technical issues are well documented in leadless pacemaker retrieval literature, with the risk of unsuccessful engagement, device migration, or even embolization described across several case series [9–11]. A particularly instructive element of this case was the premature removal of the snare during angiographic imaging. Leaving the snare in place might have facilitated subsequent localization and retrieval of the device during surgery by maintaining percutaneous control. This oversight necessitated the use of intraoperative fluoroscopy to relocate the device and added unnecessary complexity to the surgical procedure. Maintaining percutaneous control tools such as snares during transition to surgical retrieval is therefore critical, especially when device migration has occurred or is anticipated.

Although percutaneous retrieval of the Micra pacemaker is generally safe and effective – with reported success rates approaching 94% – there are important exceptions. In a multicenter study comparing retrieval experiences with the Micra and Nanostim systems, Dar *et al.* reported multiple technical challenges and procedural failures, particularly in cases involving dislodgement or fibrotic encapsulation [11]. Funasako *et al.* recently demonstrated that even non-acute retrievals of tine-based devices remain feasible but often require specialized techniques and operator experience [10]. In more complex cases, advanced strategies such as the sheath-in-sheath technique [12] or the axis-guided dual-snare approach [13] have been successfully employed to overcome difficult device positioning or altered vascular anatomy. Device embolization, although rare, has also been described. Kasagawa *et al.* reported an instance of acute pacing failure during retrieval leading to device embolization into the hepatic vein [22], demonstrating the potential unpredictability of dislodged device trajectories and the need for precise procedural control.

These cases collectively emphasize the importance of careful tether manipulation, optimal sheath support, and real-time imaging to facilitate safe retrieval and minimize complications. Surgical retrieval remains an essential rescue strategy when percutaneous methods fail, and hybrid approaches involving both endovascular and open techniques may be required in rare but critical situations. In our case, coordinated transfer to the operating theatre, fluoroscopic localization, and controlled venotomy enabled successful device extraction without complication. The patient's uneventful recovery underscores the importance of prompt interdisciplinary collaboration and escalation when needed.

As leadless pacing continues to evolve, operators must be prepared not only for routine deployment but also for potential retrieval difficulties and escalation pathways. While the Micra system offers important advantages in selected patients at increased risk of infection [1–3], procedural success ultimately hinges on anticipating rare complications, employing well-rehearsed retrieval strategies, and ensuring

robust communication between interventional and surgical teams. This case adds to the growing body of evidence by documenting a unique complication linked to transjugular access and by highlighting the technical and procedural factors that can shape outcomes in such challenging scenarios. This case illustrates a rare but significant complication associated with transjugular Micra leadless pacemaker implantation, culminating in device dislodgement and the need for open surgical retrieval. While the internal jugular approach may be a feasible alternative to transfemoral access in selected patients, it introduces additional technical considerations, particularly in cases requiring retrieval. The premature removal of the snare during angiography may have complicated subsequent device localization and retrieval, highlighting a key procedural pitfall that can be avoided in future cases. Successful resolution of this complication required prompt interdisciplinary collaboration, careful anatomical assessment, and adaptive procedural planning. As leadless pacemaker use continues to expand, clinicians must remain vigilant for potential access-related and retrieval challenges and ensure that robust escalation pathways are in place. This case underlines the importance of maintaining percutaneous control when transitioning to surgical retrieval and provides practical insights into the management of complex leadless pacemaker complications.

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Ethical approval

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Disclosures

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