Wire ThRoUgh Snare Twice (Wire TRUST) technique: a novel method to grasp a lead with inaccessible ends as a supportive femoral approach for transvenous lead extraction

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Abstract

We introduce a fast and easy method of successfully grasping a lead without a free end called the "Wire ThRoUgh Snare Twice (Wire TRUST)" technique in a 49-year-old male patient who required transvenous lead extraction (TLE) and lead replacement due to lead malfunction. Our proposed technique is less difficult than using the Needle's eye snare because the pigtail catheter is softer and has better operability. The Wire TRUST technique promptly allows a combined superior and femoral approach for TLE, even when the lead tip is difficult to free because of severe adhesion.

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Abstract

We introduce a fast and easy method of successfully grasping a lead without a free end called the "Wire ThRoUgh Snare Twice (Wire TRUST)" technique in a 49-year-old male patient who required transvenous lead extraction (TLE) and lead replacement due to lead malfunction. Our proposed technique is less difficult than using the Needle's eye snare because the pigtail catheter is softer and has better operability. The Wire TRUST technique promptly allows a combined superior and femoral approach for TLE, even when the lead tip is difficult to free because of severe adhesion.

Keywords: transvenous lead extraction, 0.014-inch guidewire, pigtail catheter, lead with inaccessible ends, supportive femoral approach, Needle's eye snare

Background

Transvenous lead extraction (TLE) is essential in the long-term management of cardiac implantable electronic devices. TLE is necessary in cases of lead infection, lead damage, lead extraction for transplant, or lead replacement.[1] Superior lead extraction is frequently used as the primary approach for TLE.[2] In some cases, using both the superior and femoral approaches for lead extraction may be necessary to achieve successful lead removal.[3] The femoral approach can be useful in a situation where there is limited space between the lead and the superior vena cava. In this situation, creating sufficient separation to allow for the safe and effective removal of the lead using only the superior approach is difficult. The femoral approach may be necessary to facilitate the advancement of a powered sheath via the superior approach. Grasping a lead without a free end is difficult. The Needle's eye snare (NES) (Cook Medical Inc., Bloomington, IN, USA) is an effective tool to grasp a lead without a free end.[3]However, the size of its loop cannot be changed and the threader is rigid. Therefore, there are instances where the loop fails to grasp a lead, leading to unsuccessful procedures and complications, such as cardiac tamponade and atrial septal perforation.[4]In this report, we propose a faster and easier method of successfully grasping a lead without a free end named the "Wire ThRoUgh Snare Twice" (Wire TRUST) technique.

Case Report

A 49-year-old male patient had undergone a dual-chamber pacemaker (Accent MRI; Abbott, Chicago, IL, USA) implantation for intermittent complete atrioventricular block 9 years previously. He provided written informed consent to personal data treatment. He was referred to our hospital for TLE and replacement of the right ventricular (RV) lead (Tendril MRI LPA1200M/52cm; Abbott) after multiple presyncope episodes owing to electrical artifact on the RV lead (Figure 1A). There were no remarkable findings on a chest X-ray (Figure 1B). A pacemaker check at our hospital showed multiple episodes of electrical artifacts in the RV lead, but no issues with the right atrial (RA) lead (Tendril MRI LPA1200M/46cm; Abbott). The patient was scheduled for TLE, replacement of the RV lead, and pacemaker generator exchange.

We performed TLE with cardiac surgery backup in a hybrid operating room under general anesthesia using a combined superior and femoral approach called "Tandem" to achieve co-axial alignment of the powered sheath with the RV lead. Initially, we freed the device from its left prepectoral pocket, and dissected the RV lead free in the superior approach. We then inserted a locking stylet (Liberator Beacon Tip; Cook Medical Inc.), which could reach the lead tip, but the fixation helix of the RV lead could not be unscrewed. A locking stylet was then deployed and secured on the lead using a one-tie accessory (Cook Medical Inc.). After confirming the patency of the subclavian vein, we performed subclavian vein puncture more distally before the lead extraction procedure to establish a new access route for the new RV lead.

Simultaneously, we initiated the femoral approach using the Wire TRUST technique. The process of the Wire TRUST technique was as follows. First, A 14Fr sheath (Check-Flo Performer; Cook Medical Inc.) was inserted into the right common femoral vein. A 4Fr pigtail catheter (Terumo, Tokyo, Japan) was inserted into the 14Fr sheath and advanced in the RA by hooking the ventricular lead under multidirectional fluoroscopic guidance (Figure 2A). A 0.014-inch guidewire (Hi-Troque Command 300 cm; Abbott Vascular) was then inserted and advanced through the pigtail catheter. After crossing the ventricular lead, the 0.014-inch guidewire was further advanced to the inferior vena cava (IVC). A 6Fr snare catheter with a 35-mm-diameter loop (ONE Snare; Merit Medical) was inserted into the 14Fr sheath side-by-side with the pigtail catheter and

then advanced into the IVC and opened in advance (Figure 2B). The distal side of the 0.014-inch guidewire was passed through the ONE Snare and withdrawn into the 14Fr femoral sheath for wire externalization (Figure 2C). After the removal of the pigtail catheter and 6Fr snare catheter, we passed both ends of the 0.014-inch guidewire through the snare outside of the body. The snare was then closed and reinserted into the 14Fr sheath (Figure 2D). After the snare catheter emerged from the tip of the sheath, the snare in the expanded position was advanced up to the vicinity of the lead (Figure 2E). Simultaneously advancing and closing the snare while tensioning the 0.014-inch guidewire after externalization securely held the lead (Figure 2F).

The RV lead was then extracted using a 14Fr GlideLight laser sheath (Philips, Amsterdam, The Netherlands) after firmly grasping it with the Wire TRUST technique (Figure 2G, H). A new RV lead (Tendril STS/2088TC-58cm; Abbott) was inserted using a newly established subclavian vein puncture site (Figure 2I). This lead was not removed because there were no issues with the data for the RA lead compared with before the procedure. The extracted lead showed fibrotic tissue with calcification (Figure 2J). A new generator (Assurity DR MRI; Abbott) was implanted, and the procedure was completed without any complications.

DISCUSSION

Previous studies have shown that incorporating the femoral approach in addition to the superior approach results in a higher rate of complete procedural success during TLE.[3,5] Furthermore, the femoral approach is favored as the primary approach and is associated with the successful advancement of a powered sheath through the superior approach. The technique for grasping leads with inaccessible ends via the femoral approach currently involves the use of an NES.[3] When the NES is not coaxially aligned with the lead, the NES is ineffective for capture. We recommend against the prolonged use of the NES during combined superior and femoral approach lead extraction because excessive attempts may increase the risk of atrial injury.[4]Our proposed Wire TRUST technique enables a combined superior and femoral approach for TLE, even when the lead tip is difficult to free owing to severe adhesion. Additionally, this technique offers a safer and quicker alternative to the NES (Figure 3).

In Wire TRUST technique, there are two procedures to pass the 0.014-inch guidewire through the ONE Snare. The first procedure involves passing the 0.014-inch guidewire that has crossed the V lead through the snare in the IVC. Aligning the snare system coaxially with the 0.014-inch guidewire in the IVC is easier than aligning it in the RA, making passing the wire through the snare easier. Manipulating the 0.014-inch guidewire while keeping the pigtail catheter hooked to the V lead makes passing the wire through the snare easier because of improvement of operability of the 0.014-inch guidewire. Inserting a 0.035-inch guidewire into the pigtail catheter causes the pigtail portion to stretch and may release the hook on the V lead. Therefore, a 0.014-inch guidewire is essential for this technique.

The second procedure involves passing both ends of the wire through the snare outside the body after externalizing the 0.014-inch guidewire. The advantages of the Wire TRUST technique are low difficulty and safety. This technique is less difficult than using the NES because the pigtail catheter is softer and has better operability. A previous report showed the usefulness of a pigtail catheter for retrieving catheter fragments with inaccessible free ends.[6] The safety of the Wire TRUST technique depends on which type of 0.014-inch guidewire is used. The 0.014-inch guidewire used for the Wire TRUST technique lacks sharp angles, similar to a NES, thereby suggesting a reduced risk of myocardial injury (Figure 2). Regarding the type of 0.014-inch guidewire, we consider the Nitinol guidewire (not stainless) to be safe because it has shape memory and does not have many sharp edges in the area where it grips the lead (Figure 2K).

Simultaneously inserting a 4Fr pigtail catheter and a 6Fr snare catheter is necessary. Therefore, a large-diameter sheath of [?]10Fr would theoretically be required for this technique (a 14Fr sheath was used in this case). Moreover, because of externalization of the 0.014-inch guidewire, manipulating the guidewire by pushing and pulling to adjust the position where the lead is held by the snare is easy (see Supplemental Video).

If the lead becomes free at the distal end during the procedure, continuing with the superior approach while

holding the lead with the Wire TRUST technique or attempting to grasp the lead again from the distal end using the ONE Snare is possible. Therefore, the lead extractor should become familiar with this technique described here for safe TLE.

Conclusions

To the best of our knowledge, this is the first report of our novel Wire TRUST technique to grasp a lead with inaccessible ends and facilitate powered sheath advancement via the superior approach.

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Figure Legends

Figure 1:

A device check shows numerous episodes of mode switching caused by oversensing of right ventricular lead noise.

A chest X-ray shows that the RA lead and RV lead have maintained their positions.

Figure 2:

(A) A 4Fr pigtail catheter hooked the ventricular lead under multidirectional fluoroscopic guidance. (B) The ONE Snare was inserted into the IVC and opened in advance. (C) The distal end of the 0.014-inch guidewire was passed through the ONE Snare and then retracted into the 14Fr femoral sheath. (D) After 0.014-inch guidewire externalization, both ends of the guidewire were passed through the snare, and the snare was reinserted into the 14Fr sheath. (E) The snare was opened and then advanced towards the vicinity of the lead. (F) Simultaneously advancing and closing the snare while tensioning the guidewire enabled grabbing the lead without a free end. (G) A 14Fr GlideLight laser sheath was advanced while grasping the lead by the Wire TRUST technique. (H) The RV lead was successfully extracted using the 14Fr GlideLight laser sheath. (I) A new RV lead was inserted. (J) The extracted ventricular lead is shown. Fibrotic tissue and dense calcifications can be seen on the extracted lead.

The 0.014-inch guidewire used for the Wire TRUST technique.

Figure 3: Schematic drawing of the "Wire TRUST" technique.

1. A 4Fr pigtail catheter hooks the targeted lead.
2. A 0.014-inch guidewire is inserted into the pigtail catheter, crosses over the lead, and then passes through the snare.
3. The 0.014-inch guidewire retracts into the 14Fr femoral sheath.
4. Externalization of the 0.014-inch guidewire.
5. Removal of the snare catheter.
6. Removal of the pigtail catheter.
7. Both ends of the guidewire are passed through the snare outside of the body and inserted into the 14Fr sheath.
8. Advancing and closing the snare while pulling the 0.014-inch guidewire can hold the lead.

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