Successful extraction of an implantable cardioverter-defibrillator lead in a patient with pocket infection via the femoral approach with a basket snare

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ABSTRACT
A 27-year-old man was admitted to our institution with implantable cardioverter-defibrillator (ICD) pocket infection. The ICD (single chamber, dual shock coils) was implanted for the prevention of aborted sudden cardiac death due to idiopathic ventricular fibrillation. Because we could not use locking stylet and countertraction maneuver, baseket snare with metal wire should be hanged at the maximal distal site of lead. With repeated simple traction, the ICD lead was completely removed. The femoral approach with snares and kits is not the first choice of lead extraction. It is indicated in cases of lead breakage, cases where other techniques fail to extract leads from the superior veins, and cases where application of excessive force to the mechanical sheaths is to be avoided. Therefore, we recommend the femoral approach with basket snare should be used in some selective cases.

Key words: device removal, implantable-cardioverter defibrillator, infection

Introduction
The application of implantable cardioverter-defibrillators (ICDs) for prevent of sudden cardiac death is well established. With the increase in patients with electronic devices and leads, removal procedures are also increasing steadily.

Lead extraction involving simple traction and countertraction techniques that are performed by using a locking stylet and polypropylene dilator sheath is the only method available in Korea. However, this conventional method cannot be performed in some complicated cases. In such cases, another extraction instrument is inevitably required.

We report the case of a patient with an infection at the pocket site who had undergone lead extraction with a basket snare via the femoral approach.

Case Report
A 27-year-old man visited our division for the evaluation of a color changes at the ICD pocket site. He had received ICD implantation 13 months before. An ICD (single chamber, dual coils; Virtuoso DR® Di64AWG; Medtronic Inc., Minneapolis, MN,
USA) was implanted for the treatment of aborted sudden cardiac death due to idiopathic ventricular fibrillation. His body temperature, pulse rate, and blood pressure were recorded 36.5°C, 78 beats/min, and 120/80 mmHg, respectively. On physical examination, showed that the ICD pocket site was pale red and had an abscess (size, 4×5 cm) however, no tenderness was observed (Figures 1A, 1B). The laboratory tests included, biochemical profile, cardiac enzyme evaluation, and a hemoglobin was also obtained. The results showed that the levels of creatine kinase MB isoenzyme, creatine kinase, and creatine kinase isoenzyme index were 1.4 ng/mL (reference range, 0.0~6.9 ng/mL), 43 U/L (reference range, 40~150 U/L), and 3.2% (reference range, 0.0~3.5%), respectively. The patient’s troponin I level was found to be elevated to 0.02 ng/mL (reference range, 0.00~0.04 ng/mL), and the high-sensitivity C-reactive protein level was 1.5 mg/dL. The results of other laboratory tests were within the reference limits. After identifying the site of pocket infection, the ICD can and pocket site debris were removed. The ICD lead was extracted with surgical back-up team 3 days after the generator was removed. The ICD lead (Sprint Quattro® 6944; Medtronic Inc.) was a tined lead, and the diameter of the lead tip and shaft (comprising the shock coil) was 2.7 mm. We performed lead extraction (Figure 2A, 2B) via the femoral approach combined with the lead–vein entry-site approach by using a basket snare. Simple traction applied via the lead vein entry site caused the lead coil to stretch. A basket snare with a metal wire was hung at the maximal distal site of lead. Furthermore, countertraction could not be used. To separate the ICD lead from the apex of the right ventricle (RV), only repeated traction force was applied to the basket snare. After applying simple traction with a basket snare for an extended period, the ICD lead was successfully removed without any evidence of lead fragments remaining in the RV. The extracted lead was found to be encapsulated with fibrous tissue and had an elongated shock coil (Figure 3). Monitoring of hemodynamic parameters and fluoroscopic examination of the cardiac silhouette were performed regularly.

Figure 1. Patient’s photograph showing the color change at the site of pocket infection and abscess formation (A, B).
**Figure 2.** Basket snare (A) and a reversible loop formed by the basket snare around the lead (B).

**Figure 3.** Extracted lead surrounded by the encapsulating fibrous tissue.
during the procedure. No evidence of major complications such as hemo-pericardium, hemothorax, or myocardial inversion was observed. We planned the insertion of a new lead after the success of ICD lead extraction was confirmed. However, the patient and his guardians did not consent to the procedure. Therefore, we discharged the patient after complete treatment of the infection and achievement of wound closure.

Discussion

Transvenous pectoral implantation of an active can has become the standard technique for ICD placement. The complication rates involving leads have been increasing with the increase in the number of ICD and cardiac resynchronization therapy defibrillator (CRT-D) implantations. Lead extraction is a high-risk procedure, with a morbidity rate of 1.4~2.5%. ICD lead extraction is known to have a higher complication rate than pacemaker lead extraction. Segments of chronically implanted leads are usually encapsulated with fibrous tissue that adheres to the major veins or ventricular wall. Lead extraction techniques are designed to free the lead from the encapsulating fibrous tissue or to free the encapsulating tissue from the vein or the heart wall. Major complications such as hemopericardium, hemothorax, and death may occur during the dissection of fibrous tissue around implanted leads. To increase the success rate of procedures involving complete lead removal, various extraction techniques have been used, including direct traction using rotational forces; traction with a locking stylet; and countertraction using a dilating sheath, femoral workstation, laser sheath, or electrosurgical sheath. Traction and countertraction performed using a locking stylet and dilating sheath is a conventional technique used in pacemaker lead extraction and ICD lead extraction techniques and has been proven to be effective and safe in clinical trials. However, this conventional kit was not available in Korea when we performed this procedure. Therefore, we performed lead extraction via the femoral approach with a basket snare. Various snares have been used in lead extraction procedures. A snare has to have enough tensile strength to support the forces required for the lead extraction procedure and provide force for aligning the target lead in different directions. Although basket snares were not developed for lead extraction, they can be used to form a reversible loop around the target lead. Forming a reversible loop is a complicated technique that involves a few specialized kits and procedures that require repeated practice to achieve perfection. By using a basket snare with a metal wire, we easily created a reversible loop around the ICD lead, thereby providing more efficient traction to the lead. Currently, the femoral approach involving snares and kits is not considered a first-line procedure for lead extraction. It is indicated in cases of lead breakage, cases where other techniques fail to extract leads from the superior veins, and cases where application of excessive force to the mechanical sheaths is to be avoided. Therefore, we recommend that lead extraction be performed via the femoral approach using basket snares only in select cases.

References


