CLINICAL STUDY

In situ formation of the loop snare technique for retrieval of foreign bodies from vessels

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Abstract

Purpose: To investigate the feasibility and effectiveness of in situ formation of the loop snare technique for retrieval of foreign bodies from vessels.

Materials and methods: We retrospectively reviewed in situ formation of the loop snare technique for retrieval of foreign bodies in 6 patients. After placing the guide wire and the loop of the gooseneck snare on each side of the tubes, the soft tip of the guide wire was caught with the gooseneck snare to form a new loop structure. The foreign body was retrieved with the new loop snare by combining the gooseneck snare and the guide wire. We reviewed the application of this technique in 6 patients with fractured central venous catheters without free ends.

Results: With in situ formation of the loop snare technique, the internal ruptured catheter was successfully removed from all of the 6 patients in about 2 to 4 min. There were no complications such as arrhythmia or heart valve injury in the 6 patients with the distal end of the fragment in the pulmonary artery or right atrium.

Conclusion: The in situ formation loop snare technique is an effective and fast means of retrieving tubular foreign bodies without free ends from vessels. Further research is needed to investigate the practical utility of the method for retrieval of all kinds of foreign bodies.

Keywords: foreign body; gooseneck snare; in situ; loop snare

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Informed consent: Informed consent was obtained before the procedures.

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INTRODUCTION

The retrieval of a foreign body in vessels or body cavities is a common procedure in the department of interventional radiology. Most of the retained foreign bodies are the fragments of a fractured central venous catheter or a drainage catheter (1-3). Although the

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incidence rate of catheter fractures in the body is low, those cather fragments may cause a variety of complications, including thrombosis, arrhythmia, and infection (4-6). In most cases, the retained foreign bodies can be removed with a snare (gooseneck or en-snare), basket catheter, or forceps technique. However, in some cases, the retrieval can be very difficult due to the special angle or position of the foreign bodies. We described here the in situ formation of the loop snare technique applied by the combining a gooseneck snare and a loach guide wire to retrieve foreign bodies.

MATERIALS AND METHODS

This is a retrospective study that was approved by the institutional review board (IRB). Informed consent was obtained before the procedures. All of the retained fractured catheter fragments were diagnosed before the procedures.

From July 2009 to August 2014, 2 males and 4 females with an average age of 55 years, (range, 22–89 y) were included in this study. There were 4 patients with a ruptured peripherally inserted central venous catheter (PICC) and 2 patients with catheter fractures of an implantable venous access port catheter (IVAP). The demographic and clinical information is listed in the Table 1.

In situ formation of the loop snare technique: A new loop snare was formed by combining a 0.035-inch loach guide wire (Terumo Coroporation, Tokyo, Japan) with a 2.5-cm diameter Amplatz gooseneck snare (Covidien, Irvine, CA, US). First, the gooseneck snare and the guide wire were introduced via an 11-Fr introducer sheath (Bard Access System, Salt Lake City, UT, US). Then the snare and the guide wire were placed on the two sides of the fractured central vein catheter. Next, the gooseneck snare was used to snare the tip of the guide wire, and then a new loop snare was created around the fractured catheter (Figure 1). Then the sheath was pushed forward to affix the new loop snare in place of the gooseneck snare. The gooseneck snare, sheath, and guide wire were pulled out of the vessel together.

RESULTS

A total of 6 foreign bodies were retrieved with the combined gooseneck snare and loach guide wire. There were 4 fractured Groshong NXT PICC catheters (Bard Access System, Salt Lake City, UT, US) and 2 X-Port isp™ implantable port catheters (Bard Access System, Salt Lake City, UT, US).

No free ends were present on the fractured catheters. The proximal end of the fractured PICC was located in the right subclavian vein, left subclavian vein, or the axillary vein (Figure 2), and the distal end was located in the right atrium (Figure 3), the right inferior pulmonary artery, or the left inferior pulmonary artery. Two patients had fractured catheter fragments, both of the port catheter. In one patient, the aforementioned fracture occurred 10 days after implantation into the left subclavian area, and an X-ray showed that the catheter had fractured and migrated. The catheter's tip had migrated to the right subclavian vein while the broken end had migrated to the right atrium. In the other patient, the fracture occurred 64 days after the catheter was implanted into the right subclavian area. The catheter moved to the superior vena cava and right atrium. With the loop snare technique, it took 2–4 min to snare the foreign body. The entire operation took 15 to 32 min (from femoral venous puncture to hemostasis), and no serve complications were observed during or after the surgery.

DISCUSSION

The retrieval of foreign bodies is a common procedure in interventional radiology departments. Although a variety of techniques, including stone basket extraction and cardiac biopsy, has been used, and new devices have been developed for the retrieval of foreign bodies, the gooseneck snare has been the most widely used device in retrieving foreign bodies(3,7). The fracture of central venous catheters is

Table 1 Profile of 6 patients with foreign body and time of operation.

Patient	Gender	Age	Etilogy	Catheter	Proximal end	Distal end	Duration of foreignbody (day)	Duration of the operation (min)
1	Female	22	Leukemia	Port catheter	Right subclavian vein	Right atrium	10	3
2	Male	48	Leukemia	Port catheter	Superior vena cava	Right atrium	1	2
3	Male	89	Colon cancer	PICC	Left axillary vein	Right atrium	1	3
4	Female	37	Ovarian cancer	PICC	Right subclavian vein	Lower left PA	10	4
5	Female	61	Cervical cancer	PICC	Right subclavian vein	Lower right PA	1	3
6	Female	71	Ovarian cancer	PICC	Left subclavian vein	Lower right PA	1	4

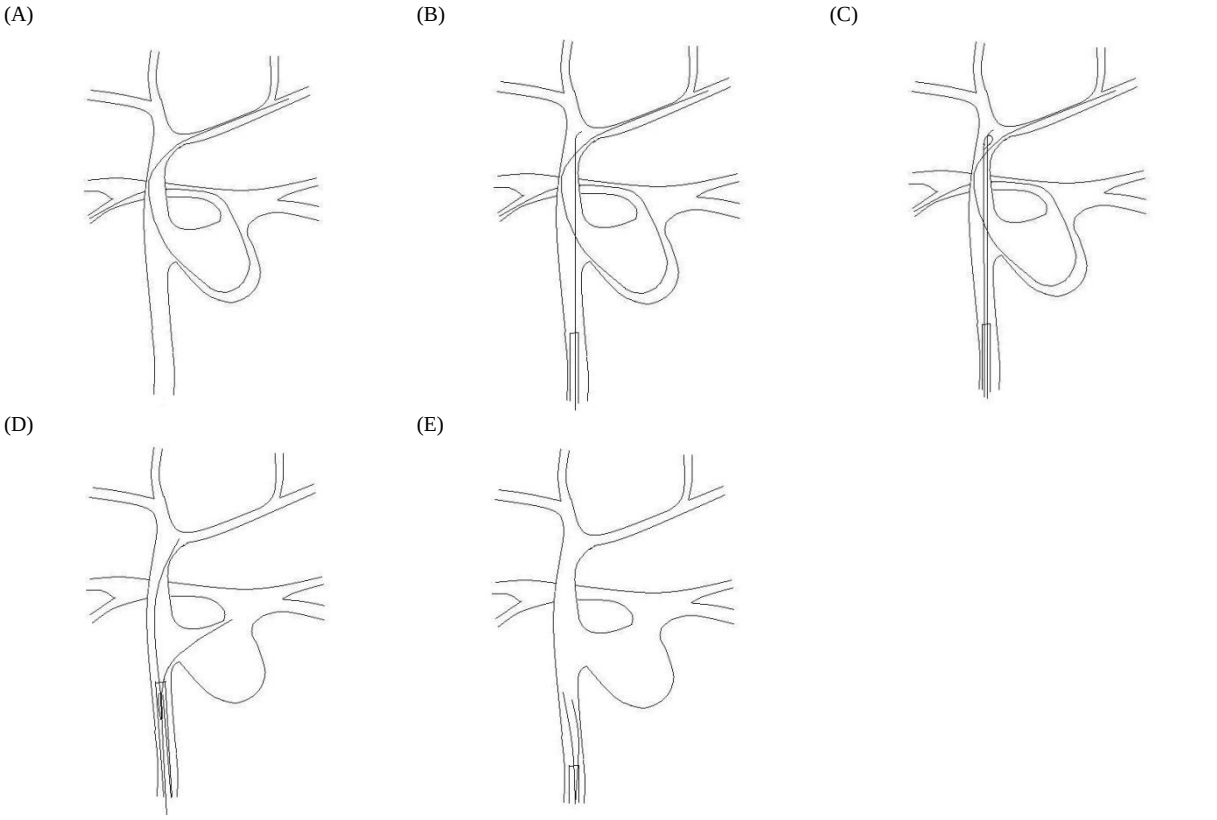

Figure 1. (A) One end of the fractured peripherally inserted central venous catheter (PICC) was located in the left subclavian vein and the other end in the right pulmonary artery. (B) We placed the 0.035 inch guide wire on one side of the PICC. (C) We then placed the gooseneck catheter on the other side to snare the guide wire. (D) We dragged the snare and the guide wire together back to the guiding catheter. (E) Finally, we dragged the guiding catheter out.

uncommon yet serious. The fractured catheters always move with the refluxed blood flow to the right atrium, some as far as the pulmonary artery. Severe complications such as cardiac arrest, pulmonary embolism, and perforation of the heart and blood vessels may occur and lead to serious results (3,6,8-12).

If the end of the fractured catheter floats in large blood vessels, such as in the superior vena cava, the free end can be easily captured with a gooseneck snare. However, in some cases, the distal end of the fractured catheter may move to the right atrium or the pulmonary artery, while the proximal end remains in the subclavian vein. In this situation, surgery in the right atrium or pulmonary artery with a gooseneck snare increases the risk of valve injury and may cause fatal complications (13,14). It has been reported that the gooseneck snare may damage the tricuspid valve when the catheter has moved to the right atrium (14). As in the 4 patients with a fractured PICC reported here, it is difficult to capture the fractured catheters with the gooseneck snare because there are no free ends. However, with the technique we described, the physician can control the loach guide wire, which makes the process easier than using the gooseneck snare alone. Although crocodile squeezers are convenient to operate, not all departments have access to them, and their use is limited by the diameter of the foreign body. There have been some case reports of port catheter displacement, but it is a moderately uncommon complication (3,15-18). We developed this technique from the report for the retrieval of a foreign bodies without free ends (19). This technique was first used in patients in our interventional radiology department who had fractured port catheters that could not be captured with a goose neck snare alone (20). This process can prevent injury to the heart valves. Another advantage is the three components of the guide wire, snare, and the foreign body in the tangent plane of the foreign body. The Texan foreign body retrieval device is similar in that the orientation of loop does not change when the snare is used to

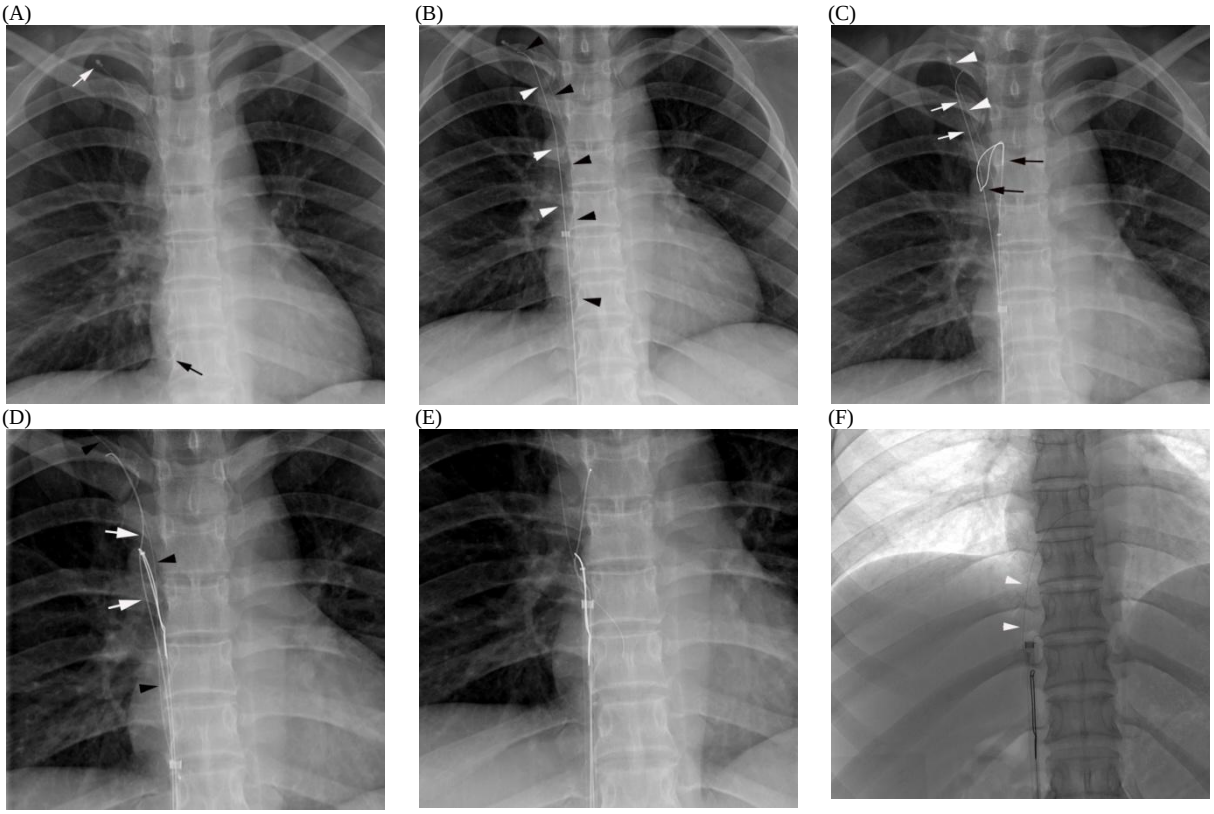

Figure 2. Female, 22 years old; implantable venous access port catheter (IVAP) fracture 10 days implantation. (A) The proximal end of the catheter had migrated to the right subclavian vein (white arrow) while the broken end had migrated to the right atrium (black arrow). (B) We introduced the 0.035-in loach guide wire through the 10F guiding catheter (white arrowhead). (C) We placed the gooseneck snare (white arrow) on one side of the IVAP (black arrow) to snare the guide wire (white arrowhead) on the other side. (D) We arranged the guide wire (white arrow) to form a circle structure, and the catheter of IVAP (black arrowhead) should be in this circle structure. (E) We used the gooseneck snare capture the end of the guide wire, then dragged the guidewire into the guiding catheter, and the fractured catheter was then dragged back into the guiding catheter. (F) Finally, we removed the guiding catheter (black arrowhead).

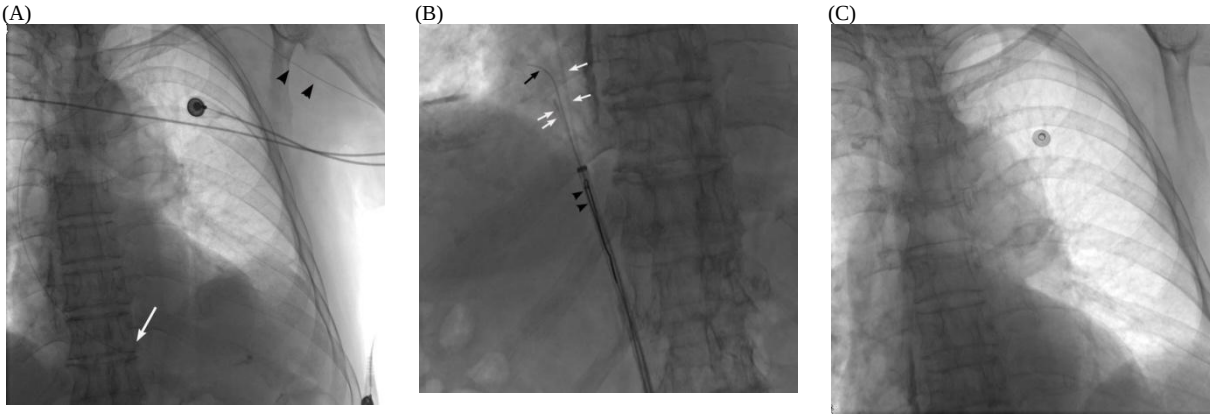

Figure 3. Male, 89 years old, 1 day after the fracture of the peripherally inserted central venous catheter (PICC). (A) The distal end of the fractured PICC is located in the right atrium (white arrow) while the proximal end in the left axillary vein. (B) Use the looping technique by combining the gooseneck snare (black arrowhead) with the loach guide wire (black arrow) together, we successfully dragged the fractured catheter (whiter arrow) back into the guiding catheter. (C) We then dragged the guiding catheter out of the blood vessel, and no residual fragments were found.

capture the foreign body (3). The in situ formation loop technique has the similar characteristic of the guide wire or the snare when the guide wire and snare are placed on each side of the foreign body. The guide wire was fixed and captured with the snare in our series of patients.

In conclusion, the looping technique combining the gooseneck snare with the guide wire can make it easier and safer to retrieve foreign bodies. The technique proves effective for retrieving foreign bodies of different diameters by providing a very sturdy retrieval apparatus that helps prevent the catheter from falling off. This new technique can help interventional physicians use simple instruments to perform tough tasks.

For retrieval of fractured PICCs like those described in our study, we suggest that using the looping technique immediately is the best choice.

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