

Retrieval of a Wire Lost During Central Venous Catheter Replacement

A case report using a new technique for wire retrieval and a review of the literature.

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Central venous catheters (CVCs) are often needed for critically ill patients as well as patients requiring long-term venous access. A rare complication associated with CVC placement is loss of the guidewire. Several techniques, often complex, have been described for the retrieval of intravascular foreign bodies. Currently, the most commonly used retrieval technique involves using a snare, most often an Amplatz Gooseneck Nitinol Snare (ev3 Inc., Plymouth, MN). However, if the complication is recognized immediately, the guidewire might still be trapped inside the lumen of the catheter. We present a simple, rapid technique that has not been previously described in the literature for removing the guidewire in this situation.

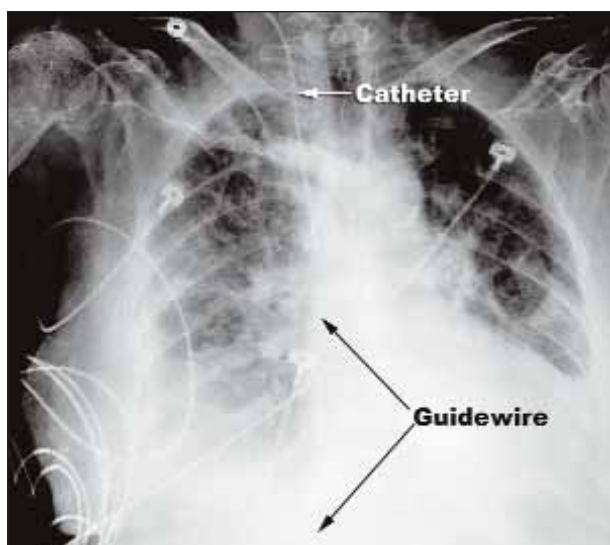


Figure 1. Immediate postprocedure portable chest radiograph showing the guidewire trapped within the catheter lumen, and the distal J tip is off the edge of the film.

CASE REPORT

A 72-year-old woman presented for repair of a 9-cm abdominal aortic aneurysm. Large-bore central venous access was obtained via the right internal jugular vein using a Cordis 8.5-F, 10-cm single-lumen sheath (Arrow AK-09803, Reading, PA). After successful open repair of the aneurysm, the patient was returned to the intensive care unit. Once large-bore access was no longer required,



Figure 2. Scout image showing the end of the guidewire located in the left femoral vein.



Figure 3. Fluoroscopic spot image showing the relationship of the catheter, .018-inch wire, and the lost guidewire.

we elected to change the Cordis catheter to a 7-F, 20-cm triple-lumen Cook Spectrum Glide catheter (Cook Medical, Bloomington, IN). During the exchange, as the new triple-lumen catheter was being advanced into place over the guidewire, the wire slipped and was noted to float into the catheter. There were no immediate cardiac events. The CVC line was left in place. Immediate plain-film chest and abdomen x-rays revealed that the wire had traveled down the catheter, through the superior vena cava, extending into the inferior vena cava; the distal J end was located in the femoral vein. The proximal straight end of the wire was still within the lumen of the catheter, although completely inside the patient (Figures 1 and 2).

An interventional radiologist was immediately consulted for wire removal, and the patient was taken emergently to the interventional radiology suite. Fluoroscopy confirmed the position of the wire. The catheter and surrounding skin was prepped and draped in sterile fashion. A Cope Mandril .018-inch wire (Cook Medical) was advanced into the central lumen where the lost guidewire resided (Figure 3). Under fluoroscopic guidance, the Cope wire was advanced alongside the larger wire until there was a snug fit. The wires overlapped by approximately 2 cm (Figure 4). Once the smaller wire could not be advanced farther, the wire and catheter were carefully removed under direct fluoroscopic guidance. The friction created by the two wires inside the lumen of the catheter allowed the entire assembly to be removed until the larger guidewire could be grasped outside the patient. Using this same wire, a new identical triple-lumen catheter was readvanced so that the tip was at the level of the superior vena cava/right atrium junction, and the wire was removed (Figure 5).

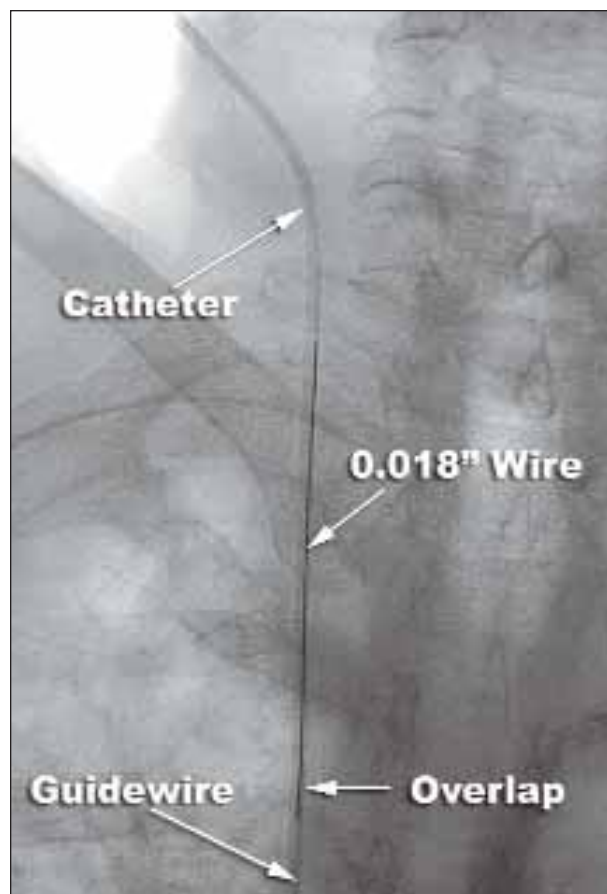


Figure 4. The .018-inch wire is overlapped alongside the guidewire within the catheter. The .018-inch wire is then held in place and the wire, catheter, and trapped guidewire are carefully removed.

After the wire was retrieved, the patient was returned to the intensive care unit. She did well with no adverse events from either the lost guidewire or from its retrieval. The CVC was successfully used with no evidence of infection or thrombosis, and there was no swelling in the left leg. The rest of her hospital stay was complicated by prolonged ventilator requirement. She was discharged on postoperative day 28 with no further complications.

DISCUSSION

With advancing technology, we encounter advancing complications. Central line placement is often a necessity during intensive care management or in patients with difficult peripheral access. Seldinger originally described his technique using a guidewire in 1953,¹ and complications were soon to follow. Loss of the guidewire is a serious and potentially life-threatening complication with reports of fatalities in up to 20% of cases when the complete wire is lost.² Unlike the fracture and dislodgement of a portion of a CVC



Figure 5. Final spot fluoroscopic image showing the new catheter in the appropriate position.

or migration of a vascular stent, loss of the guidewire is often immediately noticed, and if the wire tip stays within the catheter, it is amenable to our described technique. Complications pertaining to the guidewire include complete loss of the wire, injury to the vessel from the wire, fracture of the wire with uncoiling, the J end snaring on the end of the needle,³ and the wire becoming entangled in previously inserted intravascular devices, such as an inferior vena cava filter.⁴

Reported complication rates from central venous catheterization range from 0.3% to 12%, and they often depend on the experience level of the physician.⁵ Potential complications include failure to locate or cannulate the vein, puncture of the subclavian artery, misplacement of the catheter (defined as placement of the catheter tip in the contralateral subclavian vein or in either jugular vein), pneumothorax, mediastinal hematoma, hemothorax, and injury to adjacent nerves.

Retained or fractured guidewire or catheter fragments may lead to thrombosis, emboli, or infection. Fisher et al reported 16 deaths in 73 patients with embolized

catheters.⁶ The percutaneous retrieval of intravascular foreign bodies was first described in 1964.⁷ With currently available methods and the assistance of interventional radiologists, most broken or misplaced intravascular objects can be retrieved.^{8,9} There are numerous techniques described in the literature.¹⁰⁻¹² The majority of these techniques involve a Gooseneck snare,¹³ Dormia basket,¹⁴ the two-wire technique, a 6-F biopsy forceps, or even surgical intervention.

Today, the most commonly used retrieval technique involves using a snare,^{6,15} with the first documented use of the ev3, Inc. Gooseneck Nitinol Snare in 1991.¹³ However, these can be difficult to master and require high-quality fluoroscopy or specialized instruments. The use of the Dormia basket is associated with an increased risk of endovascular trauma.¹⁶ Some interventionists have contended that before and during the time of removal of the misplaced wire, that the patient should be anticoagulated, usually with heparin.¹⁶ Given the speed and minimal increased trauma to the patient in the procedure we describe in this article, we do not believe that our technique needs any additional anticoagulation.

Bessoud et al⁸ reviewed their institution's experience with endovascular treatment of central venous access device complications. Although their most commonly used device was the snare, the investigators noted that if the loop snare failed, then the likelihood of success with other tools was low. Our method of using a .018-inch wire is considerably less expensive than some of the other techniques described in their report.

One concern was that the .018-inch wire would not slide alongside the existing wire but push the wire out of the catheter. If this occurred, we could have reverted to a snare. The newly freed end of the wire could be snared in the superior vena cava and pulled out of the neck access. Another method for retrieval of this wire that was considered was snaring the end of the wire in the left femoral vein. However, that would entail creating a new access in either groin. Our method involved using existing right internal jugular access and eventually replacing the access with the intended catheter.

Our technique involved transporting the patient to the interventional radiology suite. However, unlike other advanced methods described elsewhere in the literature, our minimalist approach could be employed with a C-arm. This approach allows applicability at the bedside for patients in the intensive care unit who are too ill to travel. This can also be used should guidewire loss occur while the patient is under general anesthesia. The case does not have to be abandoned to travel to the interventional radiology suite.

CONCLUSION

Our technique is applicable to all types of patients, especially critically ill patients who may not tolerate prolonged procedures. This technique is simple, rapid, and has broad applicability across all institutions in attempting to retrieve a lost CVC guidewire still residing inside the catheter. ■

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TALENT™ Abdominal Stent Graft

Indications

The Talent™ Abdominal Stent Graft is indicated for the endovascular treatment of abdominal aortic aneurysms with or without iliac involvement having:

- Iliac/femoral access vessel morphology that is compatible with vascular access techniques, devices, and/or accessories;
- A proximal aortic neck length of 10 mm;
- Proximal aortic neck angulation < 60°;
- Distal iliac artery fixation length of at least 15 mm;
- An aortic neck diameter of 18–32 mm and iliac artery diameters of 8–22 mm; and
- Vessel morphology suitable for endovascular repair.

Contraindications

The Talent Abdominal Stent Graft is contraindicated in:

- Patients who have a condition that threatens to infect the graft.
- Patients with sensitivity or allergies to the device materials.

Warnings and Precautions

- The long-term performance of endovascular grafts has not yet been established. All patients should be advised that endovascular treatment requires lifelong, regular follow-up to assess their health and the performance of their endovascular graft. Patients with specific clinical findings (e.g., endoleaks, enlarging aneurysms, or changes in the structure or position of the endovascular graft) should receive enhanced follow-up. Specific follow-up guidelines are described in the Instructions for Use.
- The Talent Abdominal Stent Graft System should only be used by physicians and teams trained in vascular interventional techniques, including training in the use of the device. Specific training expectations are described in the Instructions for Use.
- Always have a vascular surgery team available during implantation or reintervention procedures in the event that conversion to open surgical repair is necessary.
- The Talent Abdominal Stent Graft System is not recommended in patients unable to undergo or who will not be compliant with the necessary preoperative and postoperative imaging and implantation studies as described in the Instructions for Use.
- After endovascular graft placement, patients should be regularly monitored for perigraft flow, aneurysm growth or change in the structure or position of the endovascular graft.
- Inappropriate patient selection may contribute to poor device performance.
- Exercise care in handling and delivery technique to aid in the prevention of vessel rupture.
- Patients experiencing reduced blood flow through the graft limbs and/or leaks may be required to undergo secondary interventions or surgical procedures.
- Intervention or conversion to standard open surgical repair following in situ endovascular repair should be considered for patients experiencing enlarging aneurysms and/or endoleaks. An increase in aneurysm size and/or persistent endoleak may lead to aneurysm rupture.
- Prior to the procedure, pre-operative planning for access and placement should be performed. See Instructions for Use.
- Renal complications may occur:
 - Prominent access site or contrast agents.
 - As a result of embol or a misplaced stent graft. The radiopaque marker along the edge of the stent graft should be aligned immediately below the lower-most renal arterial origin.
- Studies indicate that the danger of micro-embolization increases with increased duration of the procedure.
- Inadequate seal zone may result in increased risk of leakage into the aneurysm or migration of the stent graft. Other possible causes of migration are deployment of the proximal spring into a thrombus, bleed or unevenly angled vessel wall.
- The safety and effectiveness of the Talent Abdominal Stent Graft System has not been evaluated in some patient populations. Please refer to the product Instructions for Use for details.

1. Seldinger S. Catheter replacement of needle in percutaneous arteriography. *Acta Radiologica*. 1953;39:368-376.
2. Heberer M, Moser J, Durig M, et al. Prospective study of complications of central venous catheters. *Infusionsther Klin Ernahr*. 1984;11:254-261.
3. Unnikrishnan K, Sinha P, Nalgirkar R. An alternative and simple technique of guidewire retrieval in a failed Seldinger technique. *Anesth Analg*. 2005;100:898-899.
4. Wholey M, Toursarkissian B, Velez G, et al. Technique for retrieval of a guidewire lodged in a vena cava filter. *Vasc Endovasc Surg*. 2002;36:385-387.
5. Ruesch S, Walder B, Tramer M. Complications of central venous catheters: internal jugular versus subclavian access—a systemic review. *Crit Care Med*. 2002;30:454-460.
6. Fisher R, Ferreyro R. Evaluation of current techniques for nonsurgical removal of intravascular iatrogenic foreign bodies. *Am J Roentgenol*. 1978;130:541-548.
7. Thomas J, Sinclair-Smith B, Bloomfield D, et al. Nonsurgical retrieval of a broken segment of steel spring guide from right atrium and inferior vena cava. *Circulation*. 1964;30:106-108.
8. Bessoud B, de Baere T, Kuoch V, et al. Experience at a single institution with endovascular treatment of mechanical complications caused by implanted central venous access devices in pediatric and adult patients. *Am J Radiol*. 2003;180:527-532.
9. Eglin T, Dickey K, Rosenblatt M, et al. Retrieval of intravascular foreign bodies: experience in 32 cases. *Am J Roentgenol*. 1995;164:1259-1264.
10. Bogart D, Jung S. Dislodged stent: a simple retrieval technique. *Cathet Cardiovasc Interv*. 1999;47:323-324.
11. Feldman T. Retrieval techniques for dislodged stents. *Cathet Cardiovasc Interv*. 1999;47:325-326.
12. Meisel S, Di Leo J, Rajakaruna M, et al. A technique to retrieve stents dislodged in the coronary artery followed by fixation in the iliac artery by means of balloon angioplasty and peripheral stent deployment. *Cathet Cardiovasc Interv*. 2000;49:77-81.
13. Yedlicka JJ, Carlson J, Hunter D, et al. Nitinol gooseneck snare for removal of foreign bodies: experimental study and clinical evaluation. *Radiology*. 1991;178:691-693.
14. Dondelinger R, Lepoutre B, Kurdziel J. Percutaneous vascular foreign body retrieval: experience of an 11-year period. *Eur J Radiol*. 1991;12:4-10.
15. Watson L. Snare loop technique for removal of broken steerable PTCA wire. *Cathet Cardiovasc Diagn*. 1987;13:44-49.
16. Kessel D, Robertson I. *Interventional Radiology: A Survival Guide*. 2nd ed. London: Churchill Livingstone; 2000.

MRI Safety and Compatibility

Non-clinical testing has demonstrated that the Talent Abdominal Stent Graft is MR Conditional. It can be scanned safely in both 1.5T & 3.0T MRI systems under certain conditions as described in the product Instructions for Use. For additional information regarding MRI please refer to the product Instructions for Use.

Adverse Events

Potential adverse events include (not arranged in any particular order): Amputation; Anesthetic complications and subsequent attendant problems (e.g., aspiration); Aneurysm enlargement; Aneurysm rupture and death; Aortic damage (including perforation, dissection, bleeding, rupture and death); Arterial or venous thrombosis and/or pseudoaneurysm; Arteriovenous fistula; Bleeding; Hematoma or coagulopathy; Bowel complications (e.g., ileus, transient ischemia, infarction, necrosis); Cardiac complications and subsequent attendant problems (e.g., arrhythmia, myocardial infarction, congestive heart failure, hypotension, hypertension); Claudication (e.g., buttock, lower limb); Death; Graft; Embolization (micro and macro) with transient or permanent ischemia or infarction; Endoleak; Fever and localized inflammation; Genitourinary complications and subsequent attendant problems (e.g., ischemia, erosion, fistula, incontinence, hematuria, infection); Hepatic failure; Impotence; Infection of the aneurysm, device access site, including abscess formation, transient fever and pain; Lymphatic complications and subsequent attendant problems (e.g., lymph fistula); Neurologic local or systemic complications and subsequent attendant problems (e.g., confusion, stroke, transient ischemic attack, paraplegia, paraparesis, paralysis); Occlusion of device or native vessel; Pulmonary/respiratory complications and subsequent attendant problems (e.g., pneumonia, respiratory failure, prolonged intubation); Renal complications and subsequent attendant problems (e.g., artery occlusion, contrast toxicity, insufficiency, failure); Surgical conversion to open repair; Vascular access site complications (including infection, pain, hematoma, pseudoaneurysm, arteriovenous fistula, dissection); Vascular spasm or vascular trauma (e.g., bifemoral vessel dissection, bleeding, rupture, death); Vessel damage; Wound complications and subsequent attendant problems (e.g., dehiscence, infection, hematoma, seroma, cellulitis); Stent graft complications: improper component placement, incomplete component deployment, component migration, kink, break, occlusion, infection, stent fracture, graft twisting and/or kinking, insertion and removal difficulties, graft material wear, dilatation, erosion, puncture, and perigraft flow.

Please reference product Instructions for Use for more information regarding indications, warnings, precautions, contraindications and adverse events.

CAUTION: Federal (USA) law restricts this device to sale by or on the order of a physician.

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