

Surgical Removal of an Extravascular Knotted J-Tip Guidewire During Subclavian Central Venous Catheterization- A Case Report

Seongmin Park, M.D¹, Seung Bae Cho, M.D¹, Jeonghan Lee, M.D., Ph.D^{1*}¹Department of Anesthesiology and Pain Medicine, Inje University Busan Paik Hospital, Busan, KoreaDOI: [10.36347/sjmcr.2023.v11i08.009](https://doi.org/10.36347/sjmcr.2023.v11i08.009)

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*Corresponding author: Jeonghan Lee

Department of Anesthesiology and Pain Medicine, Inje University Busan Paik Hospital, Busan, Korea

Abstract

Case Report

Guidewire-related complications during central venous catheterization are relatively uncommon. However, they can still occur even with experienced physicians. This report presents a case of an extravascular knotted guidewire during central venous catheterization that required surgical removal. A 72-year-old male patient scheduled for cervical anterior interbody fusion surgery underwent left subclavian venous catheterization one day before the surgery. The J-tip guidewire was inserted through the introducer needle easily without any resistance. During the insertion of the catheter over the guidewire, the catheter did not advance more than 3 cm from the skin. The guidewire was kinked, which was further aggravated by attempts to remove it forcefully, leading to a knot formation that required surgical removal. The patient was discharged one week after the surgery without any additional complications. Safe removal of guidewires is of utmost importance, and preventive measures should be taken to reduce the risk of complications.

Keywords: Central venous catheter, Clinical practice guideline, Complications, Guidewire, Subclavian vein.

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INTRODUCTION

Central venous catheterization (CVC) is a common medical procedure that involves the insertion of a catheter into a large vein to administer fluids and medications or to monitor central venous pressure. Common sites for CVC are the internal jugular, subclavian, and femoral veins. Guidewires are used during catheterization procedures to guide the placement of the catheter in the appropriate vein. Guidewire-related complications during CVC are relatively uncommon. However, they can still occur even with experienced physicians, and currently, no guidelines are available for managing these complications. Complications related to guidewire use include failure to enter the intended location, retention of the guidewire within the body, kinking of the guidewire, and guidewire breakage [1]. Although these complications are infrequent, they have occasionally been reported in recent literature. Nonsurgical methods of guidewire removal, such as simple traction or fluoroscopically guided minimally invasive techniques [2], have been used in certain cases. However, surgical removal of a kinked guidewire, particularly a J-tip guidewire, is rare. This case report presents a case of extravascular knotting of a J-tip guidewire resulting from simple traction of the guidewire that necessitated surgical removal under general anesthesia.

CASE REPORT

A 72-year-old male patient (65 kg, 1.70 m) was scheduled for cervical anterior interbody fusion surgery. The patient was recently diagnosed with a herniated cervical disc at the C6/7 and had no other significant medical history. One day before the surgery, the left subclavian venous catheterization was attempted via an infraclavicular approach using Seldinger Technique. The 18-gauge introducer needle was inserted to pass below the clavicle and above the first rib during the first attempt. The needle further advanced parallel to the floor, through the subclavian muscle, and entered the subclavian vein. Venous return was confirmed by desaturated blood color, and the J-tip guidewire was inserted through the introducer needle easily without any resistance. After removing the needle, a 7.5 Fr tissue dilator was threaded over the guidewire, followed by an attempt to insert the 7 Fr two-lumen catheter over the guidewire. However, the catheter did not advance more than 3 cm from the skin. At this point, attempts to withdraw the guidewire failed despite moderate force, and a portable chest X-ray revealed that the guidewire was kinked in the extravascular space posterior to the middle one-half of the clavicle (Fig 1). Additional attempts to withdraw the guidewire were made with greater force, but it could not

be removed. A subsequent portable chest X-ray showed a small, complicated, and firm knot (Fig 2).



Figure 1: Supine anteroposterior chest X-ray was taken immediately after attempt to remove the guidewire failed. Guidewire kinking and looping (arrow) is confirmed below the left midclavicular space. Double lumen central venous catheter (asterisk) above the sterile drape sheet is shown in the X-ray

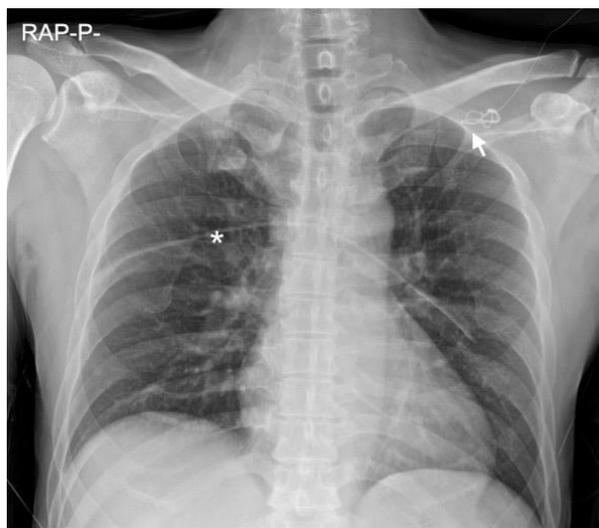


Figure 2: Supine anteroposterior chest X-ray taken after additional attempts to remove the guidewire with more force failed. Smaller, firmly made knots (arrow) are formed. Central venous catheter (asterisk) above the sterile drape sheet is shown in the X-ray

Further attempts to remove the guidewire were immediately stopped, and an aseptic dressing was applied over the whole area to cover the remaining guidewire. A cardiothoracic surgeon was consulted immediately, and a decision was made to perform surgical exploration after the induction of general anesthesia during the patient's scheduled surgery.

In the operating room, a 4 cm incision was made medial to the guidewire insertion site, and careful

dissection of the subclavian area was performed by a cardiothoracic surgeon. The guidewire had formed a knot between the pectoralis major muscle and subcutaneous fat (Fig 3) without damaging nearby blood vessels and nerves. The guidewire was cut, and the remaining portion of the guidewire was successfully removed (Fig 4).



Figure 3: Kinked and knotted guidewire was surgically removed from subclavian space between pectoralis major muscle and subcutaneous fat



Figure 4: The J-tip guidewire was cut and surgically removed from the patient. The segment of the guidewire in the patient was 15 cm in length with firmly made knots. The J-tip of the guidewire was intact, however the outer coiling wire that is attached to the inner filament wire came apart

A portable X-ray in the operation room was used to check for any remaining fragments within the patient's body. Both portions of the cut guidewire were put together to visually confirm the full removal of the guidewire (Fig 5). The incision site was sutured, hemostasis was checked, and the patient underwent his scheduled cervical anterior interbody fusion surgery. A

week after surgery, the patient was discharged without any additional complications.

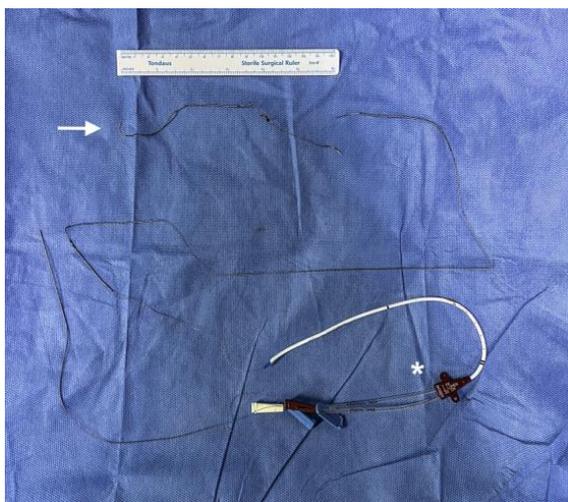


Figure 5: The removed knotted guidewire segment (arrow) was disentangled and arranged with the remaining guidewire and central venous catheter (asterisk) to visually confirm that no fragments remained in the body

DISCUSSION

Guidewire-related complications are directly related to patient safety and may lead to significant morbidity and mortality when they are not properly managed [3]. Reported complications include cardiac dysrhythmias, cardiac conduction abnormalities, perforation of vessels or cardiac chambers, kinking, looping, or knotting of the guidewire, entanglement of the previously placed intravascular devices, breakage of the distal tip of the guidewire resulting in subsequent embolization, and complete loss of the guidewire within the vascular system [3]. Despite the growing incidence of guidewire-related complications, guidelines for managing these complications are absent [4], leaving practitioners uncertain about how to take immediate measures when faced with such complications. Although our case did not develop a severe vascular injury or life-threatening consequences, the improper handling of kinking of the guidewire during catheterization led to surgical removal. This situation was potentially attributed to inadequate and poorly defined guidelines for managing guidewire-related complications.

To prevent guidewire-associated complications and handle the guidewire skillfully during CVC, it is important to comprehensively understand the guidewire structure and factors contributing to its kinking, knotting, and breakage. A J-tip guidewire consists of two parts, an inner single filament wire core surrounded by an outer covering wire that coils its entire length, and both parts are welded together at both ends [5]. The weld seam can only withstand a pull strength of approximately 17 N (1.73 kg force), whereas the entire guidewire can withstand a stress of approximately 290

N (29.57 kg force) [5]. Therefore, excessive force applied to the guidewire should be avoided to prevent the detachment of the inner wire from its outer coil.

Therefore, applying additional force after the guidewire has already looped or kinked can lead to the formation of knots. Careful attention should be paid to two critical points during the procedure to prevent the formation of knots. First, no resistance should be encountered during the insertion of the guidewire through the needle, as the guidewire should pass smoothly without any force into the vein. Second, particular care should be taken during the passage of the dilator over the guidewire to avoid forcing the dilator in a direction that diverges from the path of the guidewire, which can result in kinking of the guidewire [6]. Further forceful manipulations may create loops or knots. Thus, any resistance encountered while handling the guidewire should be addressed with extreme caution and without applying any additional force. Meticulous attention to detail can prevent complications and ensure the successful and safe use of guidewires in CVC procedures.

The most commonly used locations for central venous access include the internal jugular, subclavian, and femoral veins. It is important to understand the advantages and disadvantages of the different access sites taking into consideration the patient's clinical needs. The knotting of the guidewire is almost exclusively described in the literature following the subclavian approach, which can be attributed to the anatomical structure of the subclavian vein. This approach has a curved path with a pinch area between the clavicle and the first rib [6].

Ultrasound guidance can improve patient safety and procedural quality during CVC placement and should be used whenever possible [7]. An updated report by the ASA Task Force on Central Venous Access recommends the use of ultrasound not only for internal jugular central catheterization but also for subclavian and femoral catheterization. The report presents an algorithm for central venous insertion and verification that emphasizes the importance of visually confirming venous placement in three points: verification that the introducer needle is placed in the vein before the insertion of the guidewire, verification of venous residence of the guidewire after its insertion, and proper placement of the catheter within the vein [4]. However, in our case, ultrasound guidance was not used because the experienced practitioner did not anticipate complications and wanted to shorten the preparation time.

CONCLUSION

While knotting of guidewires during CVC is a rare complication, it can cause severe harm to the patient. Therefore, the safe removal of the guidewire is of utmost importance, and preventive measures should

be taken to reduce the risk of complications. These measures include avoiding the advancement of the guidewire if resistance is encountered, avoiding forceful removal of the guidewire, ensuring the proper direction of the dilator, using ultrasound guidance during insertion, directing the J-tip of the guidewire to the caudal position, and selecting an appropriate catheterization site. In the event of complications, it is important not to attempt forceful removal of the guidewire and to assess the position and status of the guidewire using radiologic imaging. If possible, the guidewire is recommended to be removed under fluoroscopic guidance to reduce the risk of further complications. However, if this is not possible, surgical removal with the guidance of a chest surgeon is a viable alternative. It is essential to remain vigilant and prepared to handle complications associated with guidewires to ensure the safety and well-being of patients.

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