Cardiology in the Young

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Removal of central venous catheter using Evolution® Rotating Dilator

Koichi Takamizawa[1], Eriko Hasumi[2], Katsuhito Fujiu[2] and Ryo Inuzuka[1]

[1]Department of Pediatrics, University of Tokyo Hospital, Bunkyo-ku, Tokyo, Japan and [2]Department of Cardiovascular Medicine, University of Tokyo Hospital, Bunkyo-ku, Tokyo, Japan

Brief Report

Cite this article: Takamizawa K, Hasumi E, Fujiu K, and Inuzuka R (2024) Removal of central venous catheter using Evolution® Rotating Dilator. *Cardiology in the Young* **34**: 1142–1144. doi: 10.1017/S1047951124000209

Received: 30 August 2023
Revised: 29 November 2023
Accepted: 4 February 2024
First published online: 6 March 2024

Keywords:
Central venous catheter; percutaneous removal; Evolution® Rotating Dilator; pacemaker removal system

Corresponding author:
R. Inuzuka; Email: inuzukartky@gmail.com

Abstract

We experienced the first case of a difficult-to-extract central venous catheter removed with a pacemaker lead removal system: a 14-year-old boy with Hirschsprung's disease who had repeated catheter infections that could not be removed by traction. Because the catheter lumen was occluded, a suture was tied around the end of the catheter and the catheter was removed with a rotating dilator.

Subcutaneous implantable central venous catheters are widely used in children with malignancies requiring long-term chemotherapy and with long-term gastrointestinal dysfunction. Complications of long-term placement include catheter infection, which sometimes requires removal.[1] Prolonged placement of a catheter can cause adhesions to the vessel, making removal difficult. Excessive traction can lead to catheter fracture and vessel injury, which may require open-chest surgery.[2]

Several percutaneous catheter removal techniques have been reported for such difficult cases, including sheath debridement and lumen balloon dilatation.[2] Among these, there are few reports of removal using the Rotating Dilator Catheter, which uses drill rotation to remove a pacemaker lead in cases of intravascular adhesions.[3]

We report a case of 14-year-old boy with difficulties in removing a central venous catheter, which was successfully removed using the Evolution® Rotating Dilator.

Case

A boy presented with bilious vomiting on day 1 and was diagnosed with Hirschsprung's disease. At 11 months of age, a central venous catheter was inserted due to difficulties with adequate oral feeding. Due to repeated catheter infections, the catheter was replaced repeatedly, and the latest 4.2-Fr Broviac central venous catheter was placed in the left subclavian vein at 12 years of age. At the age of 14 years, after three subsequent catheter infections, a fever triggered a blood culture that revealed *Gordonia* bacteremia and he was diagnosed with another catheter infection. After temporary control of the infection with antimicrobial therapy, an attempt was made to remove the catheter by traction in the operating room, but the catheter could not be removed due to strong adhesion and the end of the central venous (CV) catheter was ligated and implanted subcutaneously. The patient was then referred to our hospital for catheter removal. On admission, he was in good general condition and had no fever. Blood tests showed no elevation in white blood cell count or C-reactive protein, no coagulation abnormalities, and negative blood cultures. A chest radiograph and contrast-enhanced CT revealed calcification of innominate vein and the central venous catheter from the left subclavian vein to the superior vena cava.

The patient underwent central venous catheter removal under general anaesthesia, with the surgeon stand-by at the hospital during the procedure. Contrast imaging from the left forearm vein revealed an occlusion of the left subclavian vein. The central venous catheter was implanted subcutaneously with the cut end ligated and the lumen occluded by a thrombus, so a guidewire could not be passed through (Fig. 1). Despite attempting to pull the other side end of the central venous catheter with a snare catheter (AMPLATZ GOOSE NECK Snare Kit, ev3, USA) inserted through a 9-Fr sheath (Medikit super sheath, MEDKIT Corporation, Tokyo) in the right femoral vein, the central venous catheter did not move. A ligature was then bundled at the distal end, and a 7.0-Fr mechanical sheath (7.0 Fr Byrd Dilator Sheath, COOK MEDICAL JAPAN, Tokyo) was used to guide the thread in an attempt to dissolve the adhesions in the innominate vein, but they proved to be too firm. And then, a rotating dilator (Evolution® Shortie RL, COOK MEDICAL JAPAN, Tokyo, Fig. 2a) was used to dislodge the adhesions (Fig. 2b), and the central venous catheter was detached just beyond the obstruction while the snare catheter caught the distal part of the catheter. The other side end was retrieved with a snare catheter (Fig. 2c), and all catheters were removed without remnants (Fig. 2d). Left forearm venography confirmed that there was no vascular injury, and the procedure was deemed successful. The patient was discharged after completion of the procedure.

Figure 1. The disconnection of the central venous catheter, which was ligated with a suture and the lumen occluded and implanted subcutaneously.

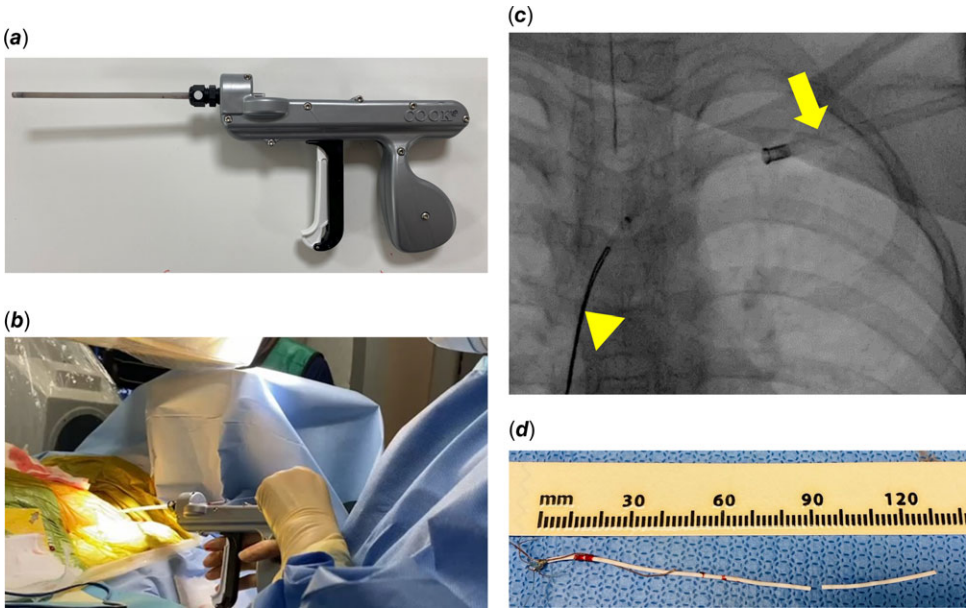

Figure 2. (*a*) The rotating dilator catheter used in this case. (*b*) The operator inserted the rotating dilator while pulling a thread tied to the distal side of the CV catheter to dissolve the adhesion. (*c*) The fluoroscopic image of the removal of the central venous catheter using the rotating dilator. The rotating dilator catheter (arrow) was rotated while viewing the fluoroscopic images and the central venous catheter was dislodged; the other side of the central venous, which had been grasped with a snare catheter (arrowhead), was retrieved. (*d*) The proximal end of the retrieved central venous catheter and the distal end with the ligature thread tied. All central venous catheters were retrieved and no remnants were left in the body.

Discussion

This is the first report of a child in whom a central venous catheter that could not be removed by traction due to adhesions was successfully removed using an Evolution Rotating Dilator.

There are several indications for the removal of CV catheters in patients with long-term indwelling CV catheters, such as occlusion, malposition, kinking, completion of treatment, and infection.[4] Infection is the most significant complication of catheter placement in children. In the study on paediatric oncology patients, a high infection rate of 1.21 per 1000 catheter days was reported.[5] The United States guidelines recommend central venous catheter removal in the presence of persistent bacteremia;[6] however, it is estimated that approximately 4% of long-term implanted central venous catheter become stuck to blood vessels

https://doi.org/10.1017/S1047951124000209 Published online by Cambridge University Press

and are difficult to remove.[7] Open-chest surgery is invasive, and balloon dilatation technique is used for removal.[2] Rotating dilators, introduced in 2015, use a drill to detach adherent pacemaker leads and are considered more useful for highly calcified lesions.[8] There are few reports of its use against central venous catheter. In adult patients, only one report of removal of an adherent central venous catheter using rotating dilators showed safe removal.[3]

The central venous catheter is easier to retrieve when the lumen is open; if the central venous catheter lumen is obstructed, it is not possible to guide the mechanical sheath or rotating dilator by passing a guidewire through the lumen, so some ingenuity is required. In this case, the central venous catheter could be guided through the mechanical sheath by tying a ligature to the end of the central venous catheter. However, the lack of a guidewire may have prevented sufficient force from being applied and the use of a mechanical sheath may have resulted in insufficient dissection of the adhesions. In addition, the use of a guide wire during the use of the rotating dilator may have increased safety. While the rotating dilator is designed for pacemaker leads and is not typically associated with high rates of damage, there is a risk of damage when using it with a softer silicone central venous catheter. In this case, the central venous catheter disconnected from the adhesion site during detachment, but the migration was prevented by holding the other end with a snare catheter. If the lumen was open and a guide wire could pass through, the risk of catheter damage would have been lower. However, when using the rotating dilator alone with a central venous catheter, as in this case, it is safer to hold the opposite side with a snare catheter or similar device to prevent potential damage. If the catheter is considered difficult to remove, it is desirable to manage the catheter with the lumen open for percutaneous removal, as the lumen will be occluded by thrombus and the guidewire will not be able to pass through if the lumen is closed by dissecting the catheter.

In conclusion, percutaneous removal using a rotating dilator should be considered as an option when central venous catheters are difficult to remove due to adhesions to the vessel.

Acknowledgements. None.

Financial support. None.

Competing interests. None.

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https://doi.org/10.1017/S1047951124000209 Published online by Cambridge University Press