

# Malfunction of a central venous multilumen access catheter caused by kinking

## A case report

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### Abstract

**Rationale:** A multilumen access catheter (MAC) is a large-bore catheter that prevents kinking or collapsing. Misplacement is a frequently reported complication.

**Patient concerns:** A 59-year-old man who was diagnosed with a hemoperitoneum due to a liver laceration after a fall.

**Diagnosis:** After catheterization, we were able to aspirate blood through the 9 Fr, but not the 12-gauge line. Thus, we assumed that the catheter was misplaced. Nevertheless, ultrasonographic findings did not reveal the reason for the malfunction. We found kinking in the distal part of the catheter after removing it.

**Intervention:** The MAC was removed soon after stopping the active bleeding.

**Outcomes:** A hemihepatectomy was successfully performed, and the patient was transferred to the intensive care unit.

**Lessons:** Anesthesiologists should consider kinking of large-bore catheters, including MACs.

**Abbreviations:** CVC = central venous catheter, CVP = central venous pressure, ER = emergency room, ICU = intensive care unit, MAC = multilumen access catheter, pRBCs = packed red blood cells, RIJV = right internal jugular vein.

**Keywords:** kinking, malfunction, multilumen access catheter

## 1. Introduction

Central venous catheterization (CVC) is a common and valuable procedure for fluid and blood infusion, drug administration, and hemodynamic monitoring in the operating room, emergency room (ER), and intensive care unit (ICU). However, it is an invasive procedure and the incidence of complications is 2% to 26%.<sup>[1]</sup> Complications include bleeding, hematoma, malpositioning of the catheter, arrhythmia, infection, pneumothorax,

and hemothorax.<sup>[2]</sup> Various efforts have been made to prevent these complications. Among them, ultrasound guidance has been recommended to reduce the number of mechanical complications, the number of catheter-placement failures, and the time required for catheter insertion, especially during internal jugular venous catheterization.<sup>[3]</sup>

A multilumen access catheter (MAC) (2-lumen central venous access set; Arrow International, Reading, PA) is a large-bore catheter that prevents kinking or collapsing. It is used for rapid fluid and blood administration during trauma and resuscitation. Furthermore, another CVC can be placed through the sheath hub to monitor central venous pressure (CVP) or apply another drug or fluid line. Functional disorder of MACs almost always results from malpositioning of the catheter. Here, we present a case of kinking of a MAC during an emergency hemoperitoneum operation due to a liver laceration.

## 2. Case report

A 59-year-old man (weight, 66 kg; height, 162 cm), classified as American Society of Anesthesiologists physical status IV E, was admitted due to mental changes and a distended abdomen after a fall. He was a chronic alcoholic and had a history of hypertension and hyperlipidemia. He had undergone cardiac tumor resection surgery 1 year previously. In the ER, his mental status was stuporous, and blood pressure could not be checked noninvasively. His heart rate was 151 beats per minute, and O<sub>2</sub> saturation was 85%. Intubation was carried out immediately. A triple-lumen CVC (ARROW Gard Blue; Arrow International) was inserted through the right internal jugular vein (RIJV) under sterile conditions. A MAC was inserted through the right femoral

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A written informed consent was obtained from the patient.

This case is not a clinical trial and just incidental interventional process so ethical approval was not necessary.

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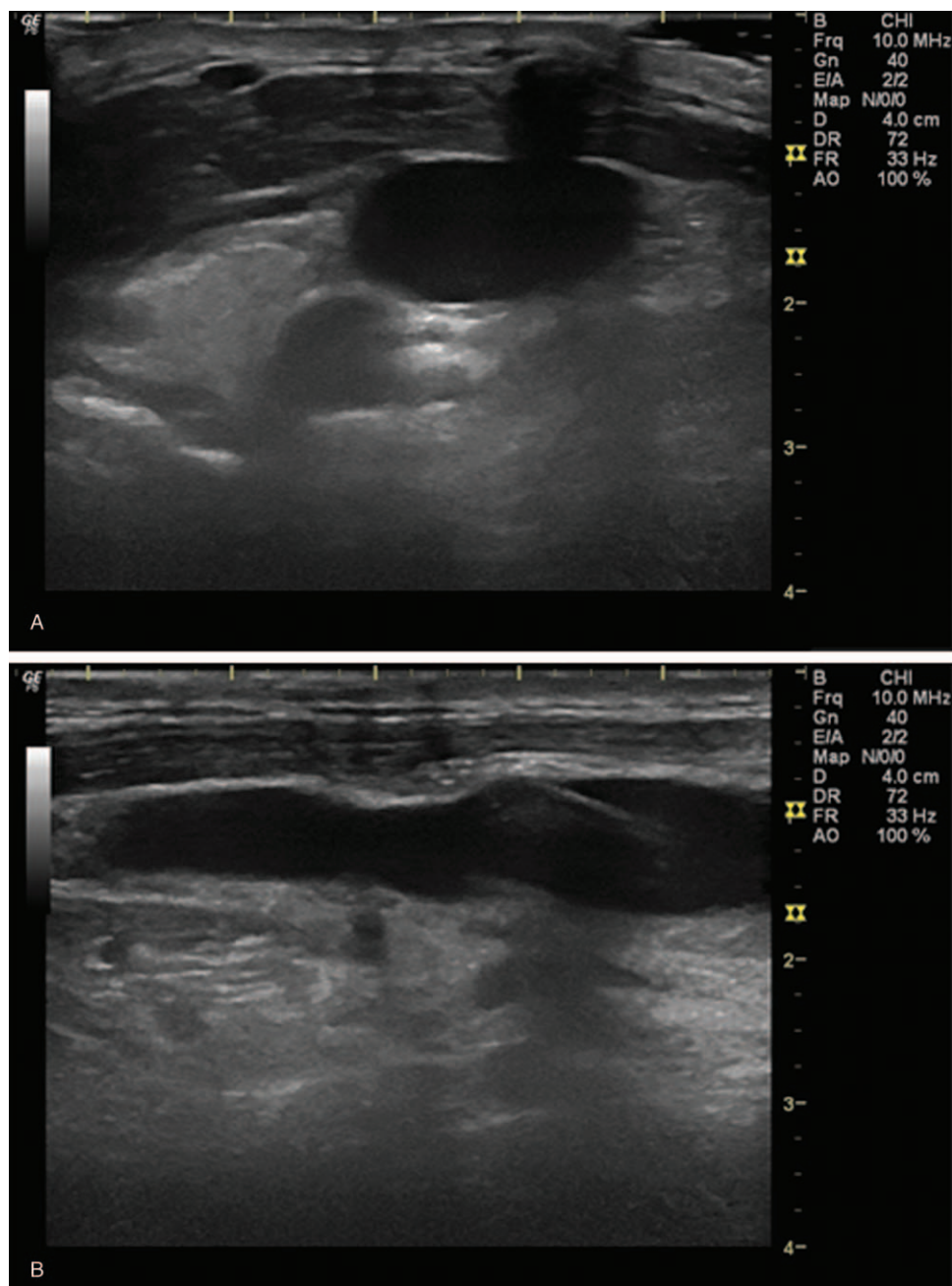
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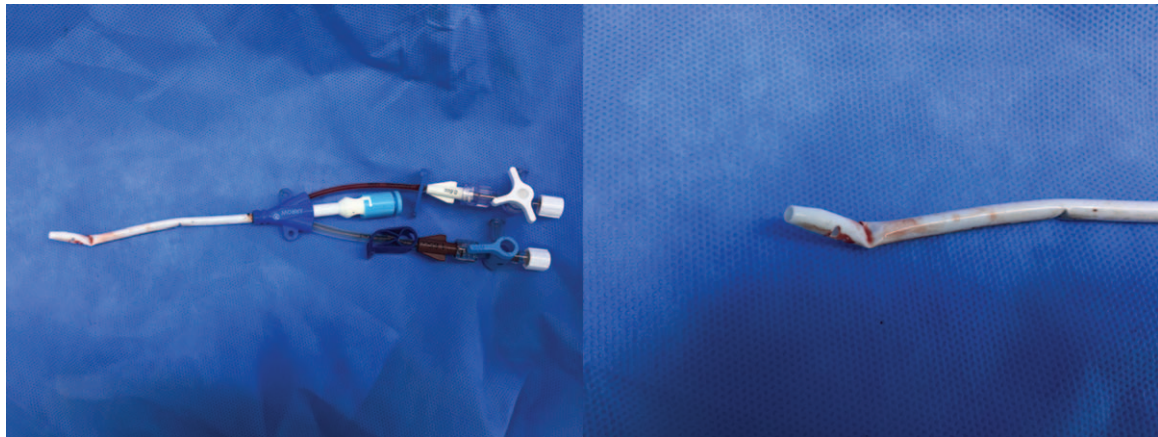


**Figure 1.** Ultrasonographic findings after catheterization demonstrated the catheter in the internal jugular vein in both cross-sectional (A) and longitudinal (B) views.

vein in the same way. After transfusing 2 units of packed red blood cells (pRBCs) to restore blood pressure, he underwent an abdominal computed tomography scan and was diagnosed with a hemoperitoneum due to a liver laceration. He underwent right hepatic artery embolization for bleeding control. The day after embolization, his symptoms indicated ongoing bleeding, so we decided to perform an emergency exploratory laparotomy.

Upon arrival in the operating theater without premedication, standard monitoring devices including electrocardiography, pulse oximetry, and an oscillometric noninvasive blood-pressure cuff were applied. General anesthesia was started and maintained with oxygen, medical air, 0.7 minimum alveolar concentration of desflurane, and a continuous infusion of 20 mg rocuronium per hour. After confirming the modified Allen test, an arterial cannula

was inserted in the right radial artery for continuous arterial blood pressure monitoring and blood sampling. Subsequently, we inserted a MAC in the RIJV using ultrasonography and the Seldinger technique, under sterile conditions and with the patient in the Trendelenburg position. The purpose of the additional MAC in the RIJV was to prepare for a blood transfusion or fluid infusion when the inferior vena cava was clamped to resect the liver, and to insert a Swan-Ganz pulmonary artery catheter. After central venous puncture and insertion of the guidewire up to 15 cm, the puncture needle was removed and the MAC-accompanying dilator was inserted through the guidewire. Central venous puncture succeeded after the first attempt, and no arterial puncture was made. Induction of anesthesia and all procedures were carried out by an expert trauma and liver transplantation



**Figure 2.** The catheter that was removed was kinked in the distal part.

team. The catheter lumens were tested with blood aspiration and a saline flush. During that time, we were able to aspirate blood through the 9 Fr, but not the 12-gauge line. Thus, we assumed that the catheter was misplaced. We decided to confirm placement of the MAC using ultrasound but could not detect misplacement or malfunction of the catheter (Fig. 1).

The patient's blood pressure dropped due to ongoing bleeding, so an immediate surgical procedure became necessary. We decided to start the operation while maintaining fluid infusion and blood transfusion via the right femoral MAC. Blood loss during the operation was about 6000 mL; therefore, 10 pints of pRBCs, 8 pints of fresh frozen plasma, and 10 pints of platelet concentrate were transfused via the right femoral MAC. Other problems, such as circulation failure or a malfunction in the right femoral MAC, did not occur during the operation or transfusion. CVP monitoring and drug infusion were accomplished by an indwelled triple-lumen right internal jugular CVC. Soon after stopping the active bleeding and checking that the patient's vital signs were stable, we removed the catheter to determine why it had malfunctioned and found a kink in the distal part of the catheter (Fig. 2). After the hemihepatectomy had been successfully performed, the patient was transferred to the ICU under sedation but without any other events.

### 3. Discussion

Hemorrhagic shock remains the leading cause of death in trauma patients arriving alive at the hospital.<sup>[4]</sup> Therefore, fluid and blood resuscitation are 2 of the most challenging aspects of trauma care. Particularly, a hemoperitoneum due to a liver injury occasionally requires a massive fluid infusion and blood transfusion. In such cases, indwelling catheterization of a large bore CVC is helpful; among them, a MAC can achieve fast volume resuscitation, while another line can be applied for CVP monitoring, and fluid and drug administration.

Complications of CVC have been categorized as mechanical, infectious, and thrombotic.<sup>[2]</sup> Ultrasound guidance during internal jugular venous catheterization reduces the number of mechanical complications, such as arterial puncture, hematoma, pneumothorax, the number of catheter misplacements, and the time required to insert a catheter.<sup>[5,6]</sup> Other factors, such as the experience of the physician, can affect the incidence of complications.<sup>[2]</sup> Conventional CVC-related mechanical obstruc-

tions may be due to a kink in a catheter, tight sutures, catheter tip blockage by a vessel wall, pinch-off syndrome, or knotting of the catheter.<sup>[7,8]</sup> In cases of large-bore catheters (such as a MAC or dialysis catheter), misplacement complications are more often reported because large-bore catheters are too stiff to kink or collapse.<sup>[9,10]</sup>

We considered 2 possibilities for kinking of the MAC. First, the catheter tip may have kinked at the precise moment of catheter insertion through the guidewire after the skin incision. Because of tension on the skin and connective tissue, this process requires forceful manipulation. Another potential reason was related to the pressure of the prepositioned catheter. Generally, in these 2 situations, anesthesiologists can feel resistance. In addition, a prepositioned conventional triple-lumen CVC is not stiff enough to kink the MAC. Nevertheless, malfunctions in a MAC can arise from kinking.

Anesthesiologists commonly suspect a misplaced catheter if blood cannot be aspirated just after catheterization, as in our case. Nevertheless, ultrasonography did not reveal a misplaced catheter and anatomical structures such as the clavicle and ribs make it hard to determine the catheter tip of a MAC. Furthermore, there were no mistakes with the procedure, and no forced manipulation of the dilator or guidewire against resistance during catheterization.

In conclusion, anesthesiologists should consider kinking of large-bore CVCs, including a MAC. In particular, an obstruction can occur just after catheterization. Furthermore, ultrasonographic confirmation of the distal part of the MAC is not easy.

### Author contributions

**Resources:** Yong Han Seo.

**Visualization:** Sang Hyun Kim.

**Writing – original draft:** Ho Bum Cho, Mun Gyu Kim.

**Writing – review & editing:** Sang Ho Kim, Jae Hwa Yoo, Hyung Youn Gong, Sun Young Park, Ji Won Chung, Jin Hun Chung.

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