

## Dissection of the posterior wall by guide-wire during internal jugular vein catheterization

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**Abstract** We report a case of posterior wall hematoma formation in the internal jugular vein after the puncture of central vein. An 82-year-old woman was scheduled for laparotomy for an abdominal incisional hernia. After induction of general anesthesia, we performed central venous catheterization via the right internal jugular vein under ultrasound guidance in the short-axis view and out-of plane technique. The ultrasound view after insertion of a guide-wire revealed a hematoma-like space on the posterior wall of the vein. We removed and reinserted the guide-wire. This time, insertion of the wire and catheter was uneventful. Seven days after the surgery, no hematoma-like space was found in the vein. The malposition of the guide-wire was detected before dilation, which enabled us to avoid complications in this case. We should note that the confirmation of guide-wire placement in the vein is important during ultrasound-guided central venous catheterization.

**Keywords** Central venous catheter · Hematoma · Ultrasound

### Introduction

Ultrasound guidance for central venous catheterization is widely used to enhance the safety of this procedure [1].

However, use of ultrasound does not remove all the risk of central venous catheterization. Life-threatening complications despite the use of ultrasound have been reported [2, 3]. We report a case of posterior wall hematoma formation in the internal jugular vein after puncture of the central vein.

### Case report

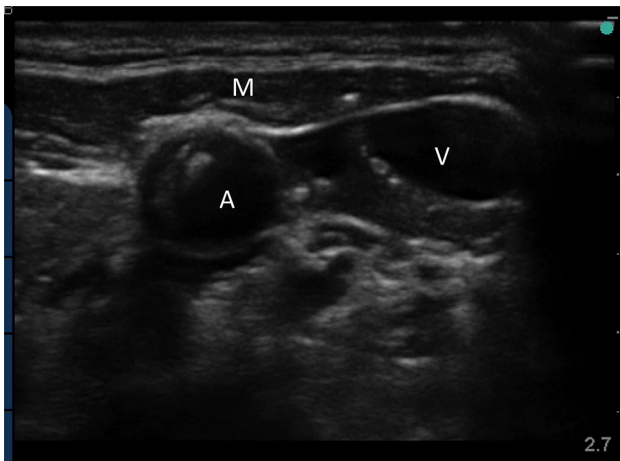
A 82-year-old woman (weight, 32 kg; height, 146 cm) was admitted to the hospital with severe epigastralgia. The patient had a history of hysterectomy for uterine cancer and an abdominal incisional hernia. Her other comorbidities included hypertension, thalamic hemorrhage, and diabetes mellitus. Because recurrence of the abdominal incisional hernia was diagnosed, emergency laparotomy with general anesthesia was planned.

For induction of general anesthesia, the patient received propofol 30 mg, remifentanil 0.2 µg/kg/min, and inhaled sevoflurane 3 %, followed by rocuronium 30 mg to facilitate tracheal intubation. Anesthesia was maintained with remifentanil 0.1 µg/kg/min and sevoflurane 1 % in oxygen.

After tracheal intubation, the patient was placed in a 10° head-down position, and the skin was disinfected and draped for placement of a central venous catheter (CV Legaforce EX; Terumo, Tokyo, Japan) into the right internal jugular vein. Ultrasound machine (S-Nerve; Fujifilm Sonosite, Tokyo, Japan) with a high-frequency (13 MHz) linear probe (HFL-38; Fujifilm Sonosite) was used to define the neck anatomy; about 50 % stenosis of right common carotid artery was detected. Therefore, real-time ultrasound-guided insertion into the right internal jugular vein using a short-axis view and out-of plane technique was chosen to avoid inadvertent puncture of the common carotid artery.

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**Fig. 1** Ultrasound short-axis view of internal jugular vein at 1 cm proximal (toward the clavicle) from needle insertion site. A hematoma-like space on the posterior wall of the jugular vein that might be related to the catheter was observed. A common carotid artery, V internal jugular vein, M sternocleidomastoid muscle

A 21-gauge metal needle was inserted into the right internal jugular vein under real-time ultrasound-guided technique once. After aspiration of venous blood, a straight-type guide-wire was introduced into the vein with some resistance. A short-axis view of the neck after insertion of the guide-wire revealed a hematoma-like space on the posterior wall of the jugular vein that might have been related to the guide-wire (Fig. 1). After removing the guide-wire, the hematoma-like space still remained. We changed the insertion point to approximately 1 cm toward the clavicle and reinserted the guide-wire into the right internal carotid vein. This time, the insertion of guide-wire and catheter was uneventful.

The surgery time was 130 min. The patient's postoperative course was uneventful. Seven days after the surgery, the central venous catheter was removed. No hematoma-like space was then found in the right internal jugular vein.

## Discussion

Life-threatening complications including arrhythmias, arterial puncture, and pneumothorax are common during the placement of a central venous catheter. Therefore, ultrasound-guided techniques have been widely used to reduce complications. However, incorrect placement still occurs even when an ultrasound-guided technique is used [2, 3]. In this case, a posterior wall hematoma in the internal jugular vein occurred after guide-wire insertion.

We used the short-axis view and out-of plane (SAX-OP) technique. This technique yielded a faster cannulation time,

and novice operators perceived the SAX approach to be easier to use than the long-axis view and in-plane (LAX-IP) approach [4]. Therefore, the SAX-OP approach is widely used for insertion of central venous catheters. However, one disadvantage of the SAX-OP approach is that real-time imaging of the needle, guide-wire, and vein during the procedure is not possible [5, 6]. Blaivas and Adhikari evaluated the frequency of posterior vessel wall penetration by needles during attempts to place internal jugular vein catheters using the SAX-OP approach by 25 residents who completed a 2-day ultrasound course. Sixteen (64 %) residents accidentally penetrated the posterior wall. This study indicated that posterior wall damage or penetration is common in this approach [7].

In this case, the needle tip might have been located in or near the posterior wall of the internal jugular vein. Then, the guide-wire was possibly inserted into the venous wall for dissection. As a result, posterior wall hematoma formation was possible in this case. The diameter of the guide-wire in this case was 0.38 mm and the tip was straight shaped. A very thin and straight guide-wire might be a risk factor for venous wall damage. Using a J-tip guide-wire might be safer for the blood vessel wall. Moreover, stenosis of right common carotid artery was detected in this case. Sclerotic changes of the blood vessel might cause a risk for hematoma formation.

According to the time course, the hematoma had shrunk gradually. Although there have been no case reports about venous dissection or hematoma formation during central venous catheterization, we speculate that this type of complication is not rare because minor vein wall tears are common and generally will go unrecognized during guide-wire/dilator/catheter insertion [8]. However, we were unaware of this finding before the wide usage of ultrasound for central venous catheterization.

Fortunately, the malposition of the guide-wire was detected before dilation, which enabled us to avoid catastrophic complications. We should notice that confirmation of the guide-wire in the vein is especially important during the ultrasound-guided SAX-OP technique.

## References

1. Miller AH, Roth BA, Mills TJ, Woody JR, Longmoor CE, Foster B. Ultrasound guidance versus the landmark technique for the placement of central venous catheters in the emergency department. *Acad Emerg Med.* 2002;9:800–5.
2. Thompson C, Barrows T. Carotid arterial cannulation: removing the risk with ultrasound? *Can J Anesth.* 2009;56:471–2.
3. Parsons AJ, Alfa J. Carotid dissection: a complication of internal jugular vein cannulation with use of ultrasound. *Anesth Analg.* 2009;109:135–6.

4. Blaivas M, Brannam L, Fernandez E. Short-axis versus long-axis approaches for teaching ultrasound-guided vascular access on a new inanimate model. *Acad Emerg Med.* 2003;10:1307–11.
5. Troianos CA, Hartman GS, Glas KE, Skubas NJ, Eberhardt RT, Walker JD, Reeves ST. Guidelines for performing ultrasound guided vascular cannulation: recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. *Anesth Analg.* 2012;114:46–72.
6. Stone MB, Moon C, Sutijone D, Blaivas M. Needle tip visualization during ultrasound-guided vascular access: short-axis vs. long-axis approach. *Am J Emerg Med.* 2010;28:343–7.
7. Blaivas M, Adhikari S. An unseen danger: frequency of posterior vessel wall penetration by needles during attempts to place internal jugular vein central catheters using ultrasound guidance. *Crit Care Med.* 2009;37:2345–9.
8. Gibson F, Bodenham A. Misplaced central venous catheters: applied anatomy and practical management. *Br J Anaesth.* 2013;110:333–46.