

CASE REPORT

An unusual route taken by a central venous catheter resulting in inadvertent subclavian artery cannulation: a case report

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Abstract

Ultrasound-guided cannulation of a central venous catheter into the internal jugular vein (IJV) was performed in the intensive care unit for a critically ill patient. The catheter was inserted into the subclavian artery distally, despite prior ultrasound confirmation of the guidewire position using both the in-plane and out-of-plane views. The catheter was removed successfully by the interventional radiologist with a closure device. To our knowledge, there have been previous case reports of subclavian artery injury during IJV cannulation with ultrasound guidance, but rarely in the setting whereby the guidewire was visualized before dilatation and railroading of the catheter. This case demonstrates that the confirmation of the guidewire in the proximal segment of the vein is insufficient to exclude arterial cannulation.

INTRODUCTION

As opposed to the carotid artery which can be easily compressed, the subclavian artery runs under the clavicle and is less accessible. The reported complications of a subclavian artery puncture include pseudoaneurysm, stroke, fistula formation and haemorrhage including haemothorax and death. Real-time ultrasound improves the success rate and reduces the risk of arterial puncture during central venous catheter (CVC) insertion [1]. Subclavian artery injury following attempted internal jugular vein (IJV) cannulation has been reported, but rarely did it occur in the setting of prior ultrasound confirmation in both the in-plane and out-of-plane views of the guidewire inside the IJV prior to dilatation and railroading of the catheter.

CASE REPORT

We report a case of an 80-year-old Chinese male who was initially admitted to the hospital for upper gastrointestinal and

intracranial haemorrhage following a fall. He subsequently developed respiratory failure and shock secondary to pneumonia, and was transferred to the intensive care unit (ICU). In the ICU, he was hypotensive, requiring vasopressors to maintain his mean arterial pressures between 50 and 60 mmHg, and hypoxemic, with a PaO₂ of 73.5 mmHg (9.8 kPa) after intubation.

Ultrasound was used during the insertion of the CVC. Following uneventful needle puncture of the IJV under ultrasound guidance, the syringe was disconnected. There was a brief flashback of dark-coloured blood, but it subsequently became non-pulsatile. No resistance was felt during the insertion of the guidewire. Following confirmation of the guidewire position in the right IJV in both the in-plane and out-of-plane views, the CVC was inserted via the Seldinger technique. However, upon transducing the CVC pressures, an arterial waveform was seen with mean pressures between 50 and 60 mmHg. The blood gas analysis of the blood sample from the CVC was consistent with arterial blood.

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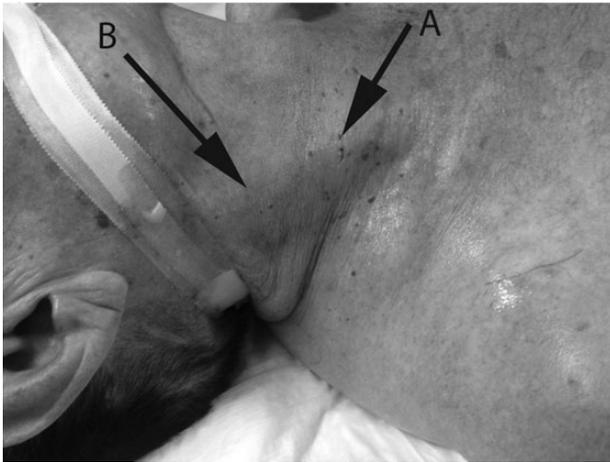


Figure 1: Actual insertion point (A) and the junction of the sternal and clavicular heads of the sternocleidomastoid muscle (B).

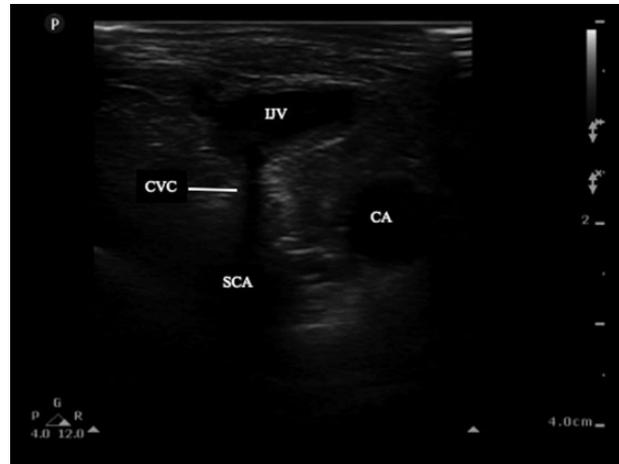


Figure 3: Route taken by the CVC. Shadow cast by the CVC. IJV, internal jugular vein; CVC, central venous catheter; CA, carotid artery; SCA, subclavian artery.

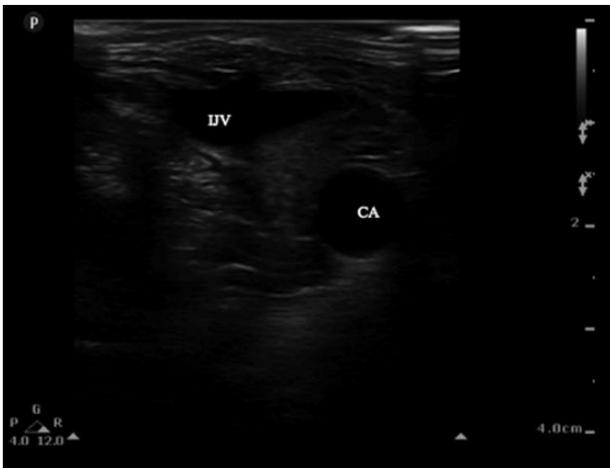


Figure 2: Ultrasound showing the IJV and CA proximal to the puncture site. IJV, internal jugular vein; CA, carotid artery.

The CVC was left *in situ* and an urgent referral was made to the vascular team. The surgeon ruled out an open repair of the vessel as anticoagulation was contraindicated due to his ongoing gastrointestinal and intracranial haemorrhage. In addition, the entry point was low (Fig. 1) and surgical control of any potential bleeding may not be possible without a sternotomy.

A bedside ultrasound (Figs 2 and 3) as well as a computed tomographic angiogram (Fig. 4) of the neck showed that the catheter had been inserted into the subclavian artery distally after traversing the IJV for a short distance.

Subsequently, a 6-Fr Angioseal closure device (St Jude Medical) was successfully inserted and deployed without any complications. An 8-mm angioplasty balloon was inflated immediately post deployment of the Angioseal to provide internal balloon tamponade and to align the foot place against the wall of the artery. The puncture site was successfully sealed off and the patient did not suffer any further complications from the insertion.

DISCUSSION

Most case reports reporting inadvertent arterial cannulation under ultrasound guidance did not report if the users had verified that the guidewire was in the vein before dilatation and railroading of the



Figure 4: Angiogram in an arterial phase.

catheter. The assumption is that arterial cannulation would be averted if this extra step was consistently taken. However, as previously mentioned by Bowdle [2], this additional step may not reliably prevent inadvertent arterial cannulation. This is one of the few case reports validating Bowdle's postulation that imaging the guidewire in the IJV is not an infallible confirmatory sign.

The puncture point in the neck was caudal to the junction of the two heads of the sternocleidomastoid muscle (Fig. 1). This made it more likely for the subclavian artery to be punctured. Most arterial punctures can be identified based on colour but hypoxemia and hypotension in this patient accounted for the blood appearing dark and non-pulsatile, even though it was arterial. This coupled with the fact that the needle tip is difficult to differentiate from the needle shaft with the out-of-plane views [2], it increases the likelihood of inadvertent arterial puncture.

Bowdle also postulated that the needle could have moved into the artery during insertion of the guidewire, which would not have been detected without the use of live ultrasound.

Measures which could have avoided this complication include using a more cephalic insertion point, limiting the depth of the needle, an in-plane ultrasound visualization approach [3], a bevel down technique [4], ultrasound to trace the distal end of the guide wire down into the thoracic inlet, four-dimensional ultrasound [5], echocardiography with or without contrast [6, 7], a 18-G cannula with manometry [8], blood gas analysis or the Finucane technique [9].

CONCLUSION

Ultrasound has been advocated to reduce complication rates as well as to increase success rates on first attempt. The National Institute for Health and Care Excellence (NICE) recommends routine use of ultrasound for insertion of central lines. This case demonstrates that the confirmation of the guidewire in the proximal segment of the vein is insufficient to exclude arterial cannulation and is not a fail-safe technique.

CONFLICT OF INTEREST STATEMENT

None declared.

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