CASE REPORT

A rare case of malposition of central venous catheter detected by ultrasonography-guided saline flush test

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SUMMARY

Central venous catheter (CVC) insertion is associated with many potential complications; malposition of the catheter is one of them. A chest X-ray is routinely done to detect the malposition of catheter, but sometimes it has been seen that X-ray is time-consuming and its accuracy is also low for determining the exact position of the catheter tip. In our case, an ultrasonography (USG)-guided CVC was placed into the right internal jugular vein of the patient. As there was no ECG change obtained during insertion of guidewire and catheter, malposition was suspected, which was easily detected by a novel USG-guided saline flush test. We present a case report where USG was used for detection of a misplaced CVC (from right internal jugular vein to right subclavian vein). With ultrasound, the location of the catheter tip can be confirmed in very less time compared with chest X-ray.

BACKGROUND

Central venous catheters (CVC) are widely used in perioperative and intensive care patient management. The various indications of putting CVC may be to administer vasopressors, antibiotics, chemotherapy, hypertonic drugs, total parenteral nutrition as well as for central venous pressure (CVP) monitoring.¹ The potential complications of inserting CVC may be an arterial puncture, pneumothorax, chylothorax, vein and nerve damage, infection, thrombosis, malposition, folding of the catheter, cardiac tamponade, air embolism, arrhythmia and even death.^{2,3} Malpositioning is a common cause of early malfunctioning of CVC.⁴ To reduce these complications, real-time ultrasound imaging during central venous cannulation is advocated. It also has promise in its ability to identify the location of the catheter tip. Although chest radiography is traditionally used to diagnose the malposition of the catheter, nowadays bedside ultrasound can also be used for this. With bedside ultrasound, there is a minimal time delay and there is no need to also shift the patient. We wish to report ultrasound detection of an unusual case of malpositioning of CVC inserted through the right internal jugular vein (IJV), which moves towards the ipsilateral subclavian vein.

CASE PRESENTATION

A 32-year-old man with a case of road traffic accident came to our centre. The patient was unconscious and haemodynamically stable with Glasgow

Coma Scale score of E1V1M5. CT revealed contusion in the left frontotemporal region with haematoma in the left basal ganglia. The patient was intubated in the emergency and shifted to neurosurgical intensive care unit (ICU) for further management. In this case, under strict aseptic precaution, ultrasonography (USG)-guided 7 Fr triple lumen catheter was inserted in the right IJV in single attempt. After the insertion of the introducer needle, guidewire went freely without any resistance and backflow of blood was confirmed in all three ports of CVC, but as during the guidewire insertion there was no ECG change, we suspected possible malpositioning of the catheter. Then to solve our suspicion, we did bedside echo especially focusing on the right side of the heart (subxiphoid view with curvilinear probe) to see the tip of the catheter, but it was not visualised. After this, ultrasound-guided saline flush test was performed to further visualise the catheter position. Ten millilitres of agitated normal saline were flushed through the distal port of the catheter, and no flush was seen when we tried to see the heart with bedside echo. Subsequently, when we tried to see other common possible site of malposition of the catheter tip, the saline flush test was positive when the right subclavian vein was visualised with linear high-frequency probe ([figure 1](#), online supplementary video). To see the right subclavian vein, the linear transducer was placed transversely on the neck, visualising the right IJV, which is followed caudally until it is seen at its confluence with the subclavian vein ([figure 2](#)). At this position, transducer was kept stationary and the saline flush test was performed. Malpositioning was further confirmed by bedside chest radiography, which showed CVC in the ipsilateral subclavian vein ([figure 3](#)). For correction of this malposition, the catheter was pulled up to 7 cm and was reinserted over the guidewire maintaining proper asepsis. Repeat ultrasound and chest radiography confirmed correct position of CVC in the superior vena cava, and it was fixed at 13 cm at the skin level. After a short stay in the ICU, elective tracheostomy was done in view of the requirement of long-term mechanical ventilation and the patient was shifted to the ward for further management in a stable condition.

DISCUSSION

Subclavian and internal jugular veins are the most commonly selected veins for placement of CVC. The right IJV is the preferred site for insertion of CVP due to its straight course to the right atrium

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Figure 1 Central venous catheter going from right internal jugular vein (IJV) to right subclavian vein (SCV).

and the lower risk of catheter malposition.² Moreover with right IJV manual compression is possible after incidental carotid artery puncture. Malpositioning is a very common complication that may vary from <1% to >60%, and migration of the subclavian catheter into the ipsilateral IJV is the most common malposition. But malposition of catheter inserted from the right IJV to the right subclavian vein is a very rare event reported in the literature.⁵ Branches of the vein, vein tortuosity, acute angulations of vessels, congenital anatomical variation and vein stenosis may contribute in misplacement.¹ Complications seen following malpositioning may be a perforation, thrombosis, haematoma, erosion of vessel wall, kinking of the catheter and failure to aspirate air in the event of air embolism, other than incorrect measurement of CVP.³ Misplaced CVC in smaller vein makes it unsuitable for parenteral nutrition, hypertonic fluids, cancer chemotherapy and sclerosant drugs. Malpositioning is also associated with the anatomic approach and the catheter type used. The incidence was found to be higher for left IJV than for right IJV approach.⁶ Use of chest radiograph after the procedure to detect CVC misplacement is recommended, but it takes time and causes additional radiation exposure.⁷ Moreover due to its two-dimensional projection, it is difficult to reliably state the

Figure 2 Position of probe to see both right internal jugular vein to right subclavian vein simultaneously.

Figure 3 Chest X-ray showing catheter passing from right internal jugular vein malpositioned into right subclavian vein.

exact position of the distal tip of CVC. USG is a very useful modality for jugular vein assessment and CVC insertion, but it has limited value in confirming catheter tip position in the SVC. But recently various studies are coming up that are suggesting that ultrasound can also be used to locate the catheter tip, thus might eliminate the need for postprocedural chest X-ray.⁸ In one study speedy detection of turbulence in the right atrium on bedside echo after CVC saline flush reliably recognised correct CVC tip location.⁹ Most recently, Vezzani *et al*¹⁰ used micro-bubble contrast-enhanced echo to detect the catheter tip in the superior vena cava. Although CT and MRI can give information regarding the exact position of the catheter, they are costly and unreasonable for routine use.

Learning points

- ▶ Ultrasound can be used to guide the insertion of central venous catheter and to confirm the proper placement of catheter tip.
- ▶ Ultrasound-guided saline flush test takes very less time compared with X-ray to diagnose malposition of catheter.
- ▶ Early diagnosis and timely management are essential to avoid any severe complications.

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