CASE REPORT

Fluoroscopy-Guided Repositioning of Malposition Central Venous Catheter During Cardiac Surgery: A Case Report

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ABSTRACT

Central venous catheter (CVC) malposition remains a recognized complication, even with ultrasound-guided insertion, and may not be detected by routine functional assessment. We present a case involving a 61-year-old male patient undergoing elective coronary artery bypass grafting, in which a right internal jugular vein CVC exhibited selective distal lumen dysfunction after insertion. Although three lumens were aspirated and flushed normally, the inability to aspirate blood from the distal lumen suggested catheter malposition. Fluoroscopic imaging confirmed the deviation of the catheter tip into the ipsilateral subclavian vein. The catheter was successfully repositioned under fluoroscopic guidance by withdrawing it with continuous aspiration, followed by saline-assisted re-advancement, which restored full lumen function. In this patient, fluoroscopic repositioning eliminated the need for repeat cannulation and its associated procedural risks. This case underscores that the normal function of some catheter lumens does not preclude malposition and that selective distal lumen dysfunction should prompt early imaging confirmation and corrective intervention.

Key Words*: Catheter Malposition, Catheter Repositioning, Central Venous Catheter, Fluoroscopy, Internal Jugular Vein.*

Introduction

The placement of a central venous catheter (CVC) is a crucial aspect of cardiac anesthesia, enabling hemodynamic monitoring, administration of vasoactive medications, and perioperative fluid management.[1] The right internal jugular vein is typically preferred because of its direct anatomical path to the superior vena cava and its association with lower complication rates. Although the use of ultrasound guidance has enhanced the safety and success of venous cannulation, it does not consistently confirm the final position of the catheter tip, and catheter malposition remains a recognized complication even with image-guided insertion.[2,3] Reported malposition rates vary from approximately 3% to 15%, with catheter tips potentially deviating into adjacent venous structures despite seemingly uncomplicated placements.[4]

Detecting malposition can be challenging because routine functional assessments, such as aspiration and flushing of the catheter lumens, do not always accurately indicate the correct tip location. Selective dysfunction of a single lumen, particularly the inability to aspirate blood from the distal port while other lumens remain functional, may serve as an early but under-recognized indicator of catheter malposition.[5]

We present a case of a mispositioned right internal jugular vein CVC in a patient undergoing coronary artery bypass grafting. In this case, selective distal lumen dysfunction prompted early imaging diagnosis and successful fluoroscopy-guided catheter repositioning.

Case Report

A 61-year-old man with triple-vessel coronary artery disease was scheduled for elective coronary artery bypass grafting. Following the induction of general anesthesia, a quad-lumen central venous catheter (8.5 Fr, 16 cm) was inserted into the right internal jugular vein under ultrasound guidance using the Seldinger technique. During guidewire advancement, mild resistance was encountered, which was resolved with minor adjustments. Post-catheter placement, three lumens were aspirated and flushed normally; however, the distal (brown) lumen failed to aspirate blood despite allowing easy saline injection, suggesting possible catheter

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malposition. Given the necessity for accurate central venous pressure monitoring, fluoroscopic imaging was performed, revealing catheter malpositioning into the ipsilateral subclavian vein (Figure 1A). Under fluoroscopic guidance, the catheter was withdrawn while continuous negative aspiration was applied to the nonfunctional lumen. Blood aspiration was restored at an insertion depth of approximately 9 cm, after which the catheter was re-advanced with saline flushing. Repeat fluoroscopy confirmed correct positioning at the superior vena cava–right atrial junction, with restoration of function in all lumens (Figure 1B). The remainder of the procedure and postoperative course were uneventful, and the patient was discharged on postoperative day six without catheter-related complications.

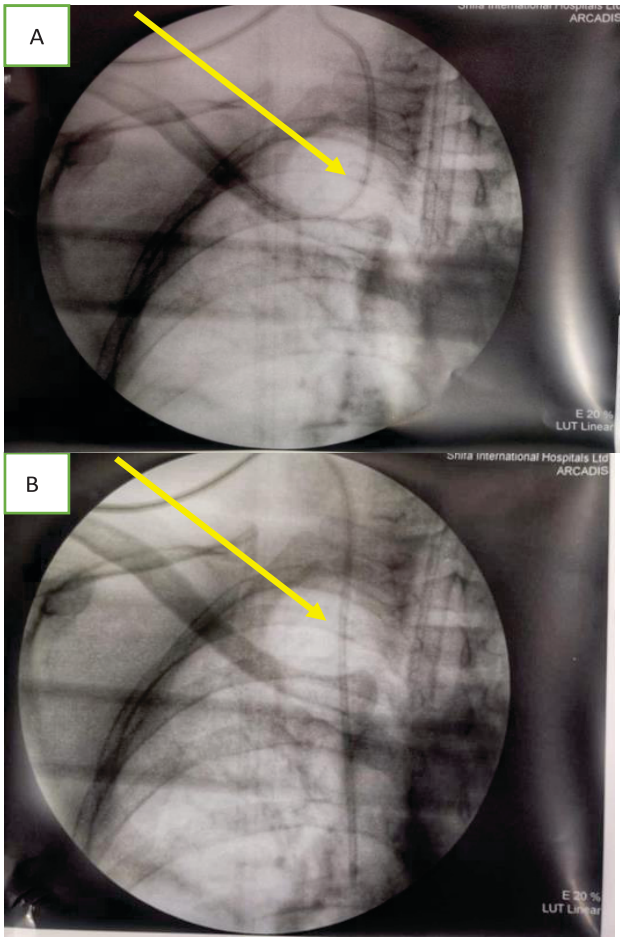

Figure 1: Fluoroscopic images of central venous catheter positioning. (A) Malposition of the catheter with deviation from the expected course toward the superior vena cava. (B) Post-repositioning image demonstrating appropriate catheter alignment within the superior vena cava.

Discussion

Central venous catheter (CVC) malposition remains a recognized complication despite the widespread use of ultrasound-guided venous cannulation.[4] The educational value of this case lies in highlighting the diagnostic clues that prompted further evaluation and ultimately led to the identification of catheter malposition. Although the three catheter lumens functioned normally in terms of aspiration and flushing, the inability to aspirate blood from the distal lumen prompted further investigation, ultimately revealing malposition of the catheter tip into the ipsilateral subclavian vein. This finding underscores a critical clinical principle; satisfactory function of one or more lumens does not reliably exclude catheter malposition, and selective lumen dysfunction should not be dismissed as a minor technical issue.

The reported rates of CVC malposition range from approximately 3% to 15%, even when ultrasound guidance is used during insertion.[4] Malposition may occur because of anatomical variations, vessel angulation, guidewire deviation, or resistance during advancement. Common malposition sites following internal jugular vein cannulation include the ipsilateral subclavian vein, contralateral brachiocephalic vein, azygos vein, and internal mammary veins.[4] In the present case, transient resistance was encountered during guidewire insertion, prior to successful catheter placement. Although this can be overcome with minor adjustments, it may represent an early indication of deviation into an unintended venous pathway. Recognition of such procedural clues should prompt heightened vigilance and consideration for early imaging confirmation.

Selective distal lumen dysfunction is an under-recognized but potentially important indicator of catheter malposition. In multilumen catheters, the distal port is located at the catheter tip and is therefore most susceptible to impaired aspiration when the tip abuts the vessel wall, enters a smaller tributary vein, or assumes an abnormal orientation. Consequently, the proximal lumen may remain functional, whereas the distal lumen fails to aspirate blood. Previous reports have similarly identified the inability to aspirate from the distal ports as a warning sign of catheter malposition.[5] However, clinicians

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should recognize that selective lumen dysfunction is not specific to malposition and may also result from catheter kinking, thrombus formation, or fibrin sheath development.[5] Nevertheless, in the setting of newly inserted catheters, unexplained distal port dysfunction should prompt immediate investigation rather than relying on routine flushing and aspiration tests alone.

This case highlights that although ultrasound guidance facilitates vessel identification and safe venous access, it fails to confirm the final catheter tip location.[6] Consequently, additional methods are required when the position is uncertain. Chest radiography remains the most commonly used confirmation technique; however, it only provides indirect assessment.[7] Intracavitary electrocardiography offers real-time localization without radiation exposure[4], whereas contrast-enhanced ultrasound[6] and bubble-test techniques demonstrate high accuracy.[6] Transesophageal echocardiography is the most accurate bedside method for directly visualizing the superior vena cava–right atrial junction.[8] In this case, fluoroscopy was employed as it was the sole modality immediately available to verify the catheter tip's position and facilitate its real-time adjustment. At that time, our institution did not routinely use advanced ultrasound-based techniques for tip confirmation. Despite the radiation exposure and the need for specialized equipment associated with fluoroscopy, it enabled prompt diagnosis and correction without delaying surgery. The real-time visualization provided by fluoroscopy was beneficial in this case, allowing for immediate diagnosis and correction without interrupting the surgical procedure. Several approaches are used to manage malpositioned CVCs, including guidewire-assisted repositioning, catheter exchange, and removal, followed by repeat cannulation[1,4]. However, in patients undergoing cardiac surgery, repeat cannulation may increase the complexity and risks, particularly when systemic anticoagulation is anticipated. In this case, catheter position was restored by fluoroscopy-guided withdrawal followed by saline-assisted re-advancement, without catheter replacement. This minimally invasive technique preserved vascular access, avoided repeated cannulation, and minimized risks associated with the procedure.

Conclusion: Selective dysfunction of the distal lumen may indicate an early sign of central venous catheter (CVC) malposition. Prompt imaging confirmation and fluoroscopic repositioning can avert the necessity for repeat cannulation in specific high-risk patients.

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Learning Points

- Normal aspiration from some catheter lumens does not exclude catheter malposition.
- Selective distal lumen dysfunction should prompt immediate imaging confirmation.
- Ultrasound guidance facilitates venous access but does not reliably confirm final tip location.
- Fluoroscopy-guided repositioning may avoid repeat cannulation in selected high-risk cardiac surgical patients.

CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.