Ultrasonography for Detection of Misplaced Central Venous Catheter: Is Chest X-ray Necessary?

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ABSTRACT
We present a case report where ultrasonography was used for detection of a misplaced central venous catheter. The position of the catheter tip can be established within less than 1 minute noninvasively using ultrasonography.

Keywords: Ultrasonography, Central venous catheterization.


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INTRODUCTION
Establishment of vascular access is a crucial task for an anaesthesiologist. Central venous cannulation can be used for rapid infusion of fluids during trauma, air emboli aspiration, repeated blood sampling, drug administration (antibiotics, vasoactive agents, chemotherapy, etc.) and central venous pressure (CVP) monitoring during major surgeries with fluid shifts such as hepatectomy, laparotomy and whipples operation.1

The incidence of complications (pneumothorax, inadvertent arterial puncture, venous air embolism and very common catheter misplacement) associated with central line insertion according to their definition and correlation with multiple factors that influence their occurrence, between 5 and 9%.2,3

To reduce the incidence of complications, central venous catheters are introduced using real-time ultrasound guidance with the position of the guidewire confirmed inside the central vein.

We present the case of a patient aged 45 years diagnosed with ovarian cancer scheduled for laparotomy. After insertion of a lumbar epidural catheter and induction of anaesthesia, peripherally inserted central catheter (PICC) was inserted through the antecubital vein. Confirming back flow of blood, catheter was fixed at 47 cm after flushing with hepsaline. For rapid confirmation of the tip of the catheter bedside echocardiography was done to visualise the heart (right atrium, ventricle, superior vena cava and inferior vena cava) through epigastric and subcostal acoustic window along the short heart axis, allowing us to see both caval veins and right atrium at the same time also known as bicaval view. Subsequently 10 ml of agitated normal saline was injected through the port of the catheter. As no flush was seen, it raised concerns regarding possible malposition of the catheter tip.

After conformation of malpositioning using X-ray (Fig. 1), PICC was withdrawn and reintroduced aseptically with patient’s arm positioned abducted and neck laterally flexed to the ipsilateral side. Confirmation of the catheter tip was done using ultrasound and the CVP monitor was applied. After surgery, a chest X-ray film was taken which showed the acceptable location of the catheter tip as illustrated by Figure 2.

The use of ultrasonography for central venous access was first described in 1978.4 Although the application of real-time ultrasonography during central line placement has minimized the failure rate, complication rate and number of attempts required for successful access, it is nowadays used for locating the catheter tip which might lead to avoidance of confirmation of the position via chest X-ray.

In 1999 Keyes et al concluded that ultrasound is a safe and rapid technique for cannulation of the brachial and basilic vein in the emergency department for patients with difficult vascular access.5 Prekker et al utilised the ‘Bubble test’, i.e. injecting saline flush for rapid confirmation of central venous catheter placement in a patient with HIV and chronic kidney disease having difficult peripheral intravenous access.6

The findings in our case are also validated by the study of Vezzani et al who determined the usefulness of B-mode ultrasonography to evaluate central catheter misplacements and detection of pneumothorax. He justified the application of ultrasonography for ensuring the accurate position of the
catheter tip in the right atrium and concluded that chest radiography will only be necessary when sonographic examination is impossible to perform by due to technical limitations.7

Although ultrasonography has become part of anaesthesia practice through its prior use in regional nerve blocks, it is eagerly being used nowadays by anaesthetists not only in guiding the site of insertion of a central venous catheter but also to authenticate the final position of the catheter tip. The position of the catheter tip can be established within less than 1 minute non-invasively using ultrasonography.

REFERENCES


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Fig. 2: Corrected position of catheter tip