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Malposition of Peripherally Inserted Central Catheter Into the Right Inferior Thyroid Vein: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Conflict of interest: None declared

Patient: Female, 58
Final Diagnosis: Breast cancer
Symptoms: None
Medication: None
Clinical Procedure: Insertion of a peripherally inserted central catheter (PICC)
Specialty: Anesthesiology

Objective: Unusual or unexpected effect of treatment





Background: A peripherally inserted central catheter (PICC) causes few serious complications but can be malpositioned. To avoid malpositioning, ultrasound guidance is widely used. Here, we report the case of a patient who received a PICC that was inserted under ultrasound guidance, but the catheter tip accidentally entered the right inferior thyroid vein.

Case Report: A 58-year-old woman was scheduled for reconstructive mammoplasty. After general anesthesia, a PICC was inserted via the right basilic vein. The PICC was inserted under guidance using a portable ultrasound machine with a high-frequency linear transducer. The tip of the guide wire and catheter were confirmed by ultrasound to be in the right subclavian vein, not in the right internal jugular vein, during insertion. However, the chest X-ray performed after the PICC insertion showed that the catheter had moved into the right inferior thyroid vein.

Conclusions: Malpositioning of a PICC can occur into any small vein. Ultrasound should be used not only to avoid malpositioning into the IJV, but also to confirm the proper position of the catheter tip during PICC insertion.

MeSH Keywords: Anesthesiology • Catheterization, Central Venous • Ultrasonography

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Background

A peripherally inserted central catheter (PICC) is a type of central catheter that is inserted into the peripheral vein of the elbow or upper arm, such as the basilic vein [1,2]. A PICC causes few serious complications such as pneumothorax and fetal arrhythmia, but malpositioning of the catheter tip can occur [3–5]. To avoid malpositioning, X-ray fluoroscopy or ultrasound diagnostic equipment are used for guidance in clinical settings [6,7]. Ultrasound systems are also used to visualize the vein at the insertion site and to ensure that the catheter is not inserted incorrectly, such as into the internal jugular vein (IJV) or opposite subclavian vein (SV).

We report the case of a patient who received a PICC that was inserted under ultrasound guidance, but the catheter tip was malpositioned into the right inferior thyroid vein.

Case Report

We received written permission from the patient to publish this report. A 58-year-old woman (height 157 cm, weight 52 kg) was scheduled for reconstructive mammoplasty after left breast cancer surgery with vascularized free flaps. General anesthesia combined with thoracic epidural anesthesia was scheduled. General anesthesia was induced using propofol (100 mg) and fentanyl (100 µg) with standard ASA monitors, and the patient was intubated tracheally using rocuronium (40 mg). Anesthesia was maintained with sevoflurane and remifentanyl. A PICC was inserted via the right basilic vein. The patient was placed in the supine position, with her elbow extended and her shoulder externally rotated. The PICC was inserted under guidance of a portable ultrasound machine with a high-frequency linear transducer (HFL38x, 6–13 MHz; Fujifilm Medical, Japan). An intravascular catheter (Double lumen catheter, 4.5 Fr; Medtronic, U.S.A.) was inserted under ultrasound guidance via the basilic vein of the right brachium.

The tip of the guide wire and catheter were confirmed by ultrasound to be in the right SV, not in the right IJV, during insertion. Slight resistance was encountered when the catheter was inserted approximately 25 cm, but it was relatively smoothly inserted. The catheter was then further inserted, and aspiration was performed to check for blood from the catheter. However, the chest X-ray performed after the PICC insertion showed that the catheter had moved in the cranial direction (Figure 1).

The ultrasound system indicated that the catheter was in the IJV, but we subsequently discovered that it was not. A linear probe was positioned on the right supraclavicular fossa by placing it parallel to the clavicle and then tilting it to see the inside of the thoracic cavity. The ultrasound showed that the

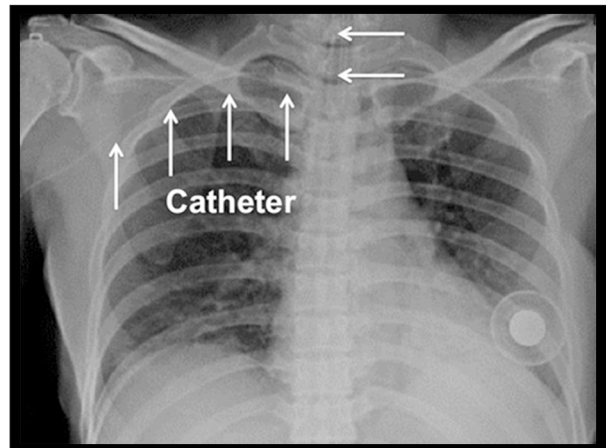


Figure 1. Chest X-ray after insertion of the PICC catheter. The catheter moved in the cranial direction.

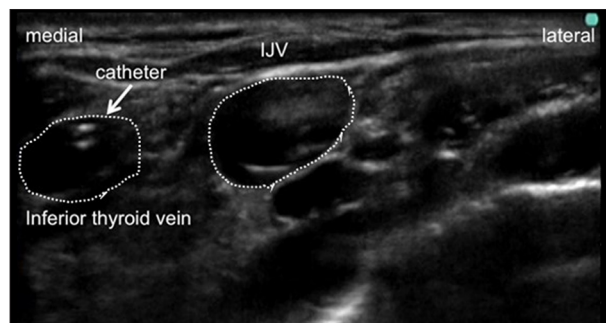


Figure 2. Ultrasound image of the right supraclavicular fossa. The catheter is observed in the inferior thyroid vein instead of the IJV.

catheter was running inside the right IJV (Figure 2). According to the anatomical relationships, the catheter was located in the right inferior thyroid vein. After withdrawing the catheter, it was placed in the proper position.

Discussion

In the present case, to avoid malpositioning of the catheter, we used ultrasound to confirm that the catheter tip was in the right SV, not in the right IJV. However, the catheter went in the cranial direction.

Major complications of PICC are infections and venous thrombosis, but there may also be injury to nerves, muscle, and soft tissue, as well as hematomas and arrhythmia due to a guide wire, and catheter malpositioning can also occur [3]. Malpositioning of a PICC occurs in about 8% of procedures, and the IJV is the most common location for misplacement [8,9]. To avoid malpositioning of the catheter tip into the IJV, it is important to confirm by ultrasound that the guide wire and catheter are in the SV of the punctured site and not in the IJV [2].

However, malpositioning of the tip into the external jugular vein and upper limb veins also has been reported [9]. There has been only 1 case reported in which the tip of a PICC was malpositioned into the right inferior thyroid vein, but ultrasound and/or fluoroscopy was not used in that case [10]. The right inferior thyroid vein usually runs along the front surface of the trachea from the thyroid gland. A study using computed tomographic scanning from the neck to the chest of a subject showed 3 patterns by which the right inferior thyroid vein flowed: 27% of the studied veins flowed into the right IJV, 32% flowed into the innominate vein, and 41% flowed to the junction of the bilateral brachiocephalic veins [11]. Thus, a catheter can become malpositioned into the right inferior thyroid vein because there are openings in the right IJV or right brachiocephalic vein leading to the right inferior thyroid vein.

Therefore, it is important to confirm the proper position of the tip, using methods such as radiography, intravenous electrocardiogram, and ultrasound [2,12]. It is standard procedure to confirm the position of a central catheter with a chest X-ray, and it was recently reported that it is also useful in bedside ultrasound techniques such as using subcostal 4-chamber view [13] and saline flush test [6]. In a systematic review and meta-analysis, the accuracy of bedside ultrasound techniques to confirm the central catheter position was shown to have higher sensitivity and specificity compared with radiography [7]. The point-of-care use of transthoracic echocardiography to confirm the proper position of the catheter also reduces the catheter insertion time and improves patient safety [6,7].

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Use of a guide wire is also important to avoid malpositioning. In the present case, we used an angulated type of guide wire. An angulated or straight guide wire can move into the inferior thyroid vein because of the anatomical relationship between the right inferior thyroid vein and the brachiocephalic vein. In our case, slight resistance was encountered when the catheter was inserted about 25 cm, even though we confirmed by ultrasound that it had not entered the IJV. Even if little resistance is encountered, the catheter may enter a small vein, including the intracranial vein, and can pose a risk of malpositioning or vascular injury. Another type of the guide wire, the flexible J wire, can be used to avoid this problem [14, 15]. Guidewire-related complications such as a missing guidewire, which is rare but lethal, are also reported, and use of ultrasound guidance during PICC insertion is also recommended [16].

Conclusions

Malpositioning of the PICC can occur into any small vein. Ultrasound should be used not only to avoid malposition into the IJV, but also to confirm the proper position of the catheter tip during PICC insertion.

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Conflicts of interest

None.