Complications of Central Venous Catheterization in Laparoscopic Radical Transverse Colon Cancer Surgery: A Case Report

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1. Abstract
Pneumothorax is a common complication of central venous catheterization and is commonly seen in cases with subclavian access, repeated punctures, or oversized catheters. Few cases have been reported in which the puncture procedure was uneventful and normal, but the catheter penetrated the vein wall due to body position. Here, we report a case of a 68-year-old female patient who underwent laparoscopic radical surgery for transverse colon cancer. One Arrow double-lumen catheter was placed in the right internal jugular vein under preoperative ultrasound guidance, and the first puncture was successfully placed and used normally during the operation. Poor catheter reflux and mild subcutaneous neck emphysema were noted 1 hour after the surgery, and CVC malposition was suspected. Chest CT confirmed that the catheter tip was partially extravascular resulting in a right pneumothorax and mediastinal emphysema. The catheter was immediately removed, and a backup vein was established.

2. Introduction
Central venous catheterization is an invasive medical procedure typically used to obtain vascular access for indications. It is commonly used in patients requiring large fluid infusions, vasoactive drugs, chemotherapy administration, total parenteral nutrition, cardiac catheterization, and transvenous cardiac pacing. Complications of central venous catheterization have been reported and include pneumothorax, hemothorax, nerve injury, arteriovenous fistula formation, catheter rupture, embolization, and catheter malposition. Of these, CVC ectasia is a known complication of IJV placement with an incidence of 1-2%. We report a rare case of extravascular ectopic internal jugular vein catheter with right-sided pneumothorax and mediastinal emphysema after laparoscopic radical surgery for hemi colonic cancer. The catheter was removed immediately after the discovery, and the patient made good clinical progress and is about to be discharged from the hospital. Central venous placement was first reported in 1929 when Dr. Werner Forssman punctured the median vein of his elbow and placed a ureteral catheter into the right atrium [1]. Central venous placement (central venous placement is defined as percutaneous placement of the catheter tip in the superior vena cava, right atrium, or proximal 1/3 of the inferior vena cava) became common in clinical practice. Globally, 27 million CVCs are performed annually [2]. However, CVC has been accompanied by numerous complications since its inception, which can be categorized into early and late complications. Early complications include arterial puncture, arrhythmia, bleeding, nerve injury, catheter misalignment or breakage, air embolism, or pneumothorax. Late complications include infection, thrombosis, and catheter dysfunction [3]. The route of catheter placement is the main reason for the differences in the rates of different complications. The placement pathways are internal jugular vein, subclavian vein, PICC, or femoral vein, and pneumothorax occurs mainly in the subclavian approach [4], with an incidence of 4.4 cases per 1000 catheters placed (95% CI, 2.7-6.5) [5]. Risk factors for pneumothorax are larger catheter sizes and increased puncture attempts as a recent complication [6]. If the size of the pneumothorax is <15%, it can be treated conservatively with high-flow oxygen, but hypoxia and hemodynamic instability...
require emergency closed chest drainage, and severe pneumotho-
rax can lead to cardiac arrest.

3. Case Report

This patient is a 68-year-old female, height 157 cm, weight 50 kg. She was admitted to the hospital with “Upper and middle abdomi-
nal pain for 1 month, aggravated for 3 days”, and transverse colon lesions were seen on electron colonoscopy. She denied a history of cardiovascular disease, diabetes mellitus, long-term medication, and only one left knee arthroscopy in the operating room in 2016. Preoperative investigations were completed, and he was proposed to undergo laparoscopic radical transverse colon cancer surgery. The patient was admitted to the room with NIBP, EKG, and SpO2 monitoring, head down and feet up at 20°, and a 14-GArrow dou-
ble lumen catheter was successfully inserted under ultrasound guidance. Seldinger technique was used in the first attempt with-out any resistance. Reflux was observed in all ports, confirming the correct position of the central venous catheter. Ultrasound fur-
ther confirmed that the catheter was in the IJV. Venous sequential induction through the CVC was successfully performed and the trachea was intubated. The patient maintained stable hemodynam-ics throughout and during surgery with ventilation settings of Vt 400mL, RR 12bpm, and PEEP 3cmH2O. Surgical position hern-
ringbone + head down and feet up 30°, and pneumoperitoneum pressure 14cmH2O, the surgery lasted 5 hours, with intraoperative rehydration of 3,000mL (2,000mL of Ringer’s solution with lactate, 500mL of Ringer’s solution with acetate, and 0.9% sodium chloride 250mL + cefuroxime sodium 1.5g * 2 times), urine vol-
ume of 1000mL. The tube was extubated in the PACU 30 minutes after the end of the surgery, and the patient had no complaints of discomfort. Thirty minutes after extubation, the patient was sent to SICU, and a few subcutaneous emphysema in the neck was found, and the main and side tubes were not pumping back. CVC was im-
mediately removed, and a bedside chest X-ray suggested a small right-sided pneumothorax and a small mediastinal emphysema (Figure 1). Chest CT suggested a small right-sided pneumothorax and mediastinal emphysema, and the tip of the CVC was partially extravascular (Figure 2). The catheter was immediately removed, the backup vein was opened, and the patient had no complaints of discomfort. The subcutaneous emphysema was absorbed after 2 days (Figure 3), and the patient was discharged one week after the operation.

![Figure 1: Bedside chest X-ray (the day of the surgery): Right-sided pneumothorax and mediastinal emphysema.](image1)

![Figure 2: Chest CT (the day of the surgery): Right-sided pneumothorax, subcutaneous emphysema, mediastinal emphysema, and the tip of the CVC was partially extravascular.](image2)
the ESA 2020 guidelines recommend using real-time ultrasound as a safe and effective tip localization strategy, and the recently published echo tip and Neo-ECHOTIP protocols fully describe how real-time ultrasound can be used for such purposes. The depth of catheter placement varies depending on the site of placement. The tip of a central venous catheter (CVC) should be positioned in the proximity of the cavo-atrial junction (CAJ) where the lower third of the superior vena cava (SVC) and the upper right atrium (RA) are located to prevent life-threatening complications [12, 13]. Peres first described the formula based on the patient’s height in 1990 [14]. According to this formula, the right IJV’s placement depth should be height (cm)/10 cm, with a correct rate of 84.7% [15]. In our case, the depth of placement was 10 cm, which may have been positioned high, and the subsequent head-down surgical position and CO2 pneumoperitoneum resulting in visceral organs due to gravity and extrusion may have caused downward movement of the catheter tip and penetration of the vein wall. Although the exact time when the penetration occurred is uncertain, the probability is that it was during the second half of the operation. Fortunately, a small amount of right-sided pneumothorax and mediastinal emphysema happened in this case without severe respiratory dysfunction or hemodynamic fluctuations.

5. Conclusion
This case suggests that even when the puncture procedure goes very smoothly, the position of the catheter tip can still be affected by a change in body position. Not only do we need to observe the position of the catheter tip throughout the puncture and catheterization operation, but we also need to be vigilant for catheter tip displacement during frequent intraoperative position adjustments.

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Exploring the effects of dexamethasone on pathological pain-induced anxiety-depression-like behavior based on inflammatory NLRP3.

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