Annals of Clinical and Medical Case Reports

Case Report ISSN 2639-8109 | Volume 13

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

Wen Juan Liu* and Shu Yan Wang

Department of Anesthesiology, Tongren Hospital, Shanghai Jiaotong University School of Medicine, Shanghai City, China

***Corresponding author:**

Wen Juan Liu,
Department of Anesthesiology, Tongren Hospital,
Shanghai Jiaotong University School of Medicine,
Shanghai City, China

Received: 01 July 2024
Accepted: 22 July 2024
Published: 29 July 2024
J Short Name: ACMCR

Citation:

Wen Juan Liu, Complications of Central Venous Catheterization in Laparoscopic Radical Transverse Colon Cancer Surgery: A Case Report.
Ann Clin Med Case Rep. 2024; V13(23): 1-4

Keywords:

Central venous catheterization; Right jugular vein; ultrasound-guided; CVC malposition; Pneumothorax

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 pneumothorax 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 abdominal 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 double lumen catheter was successfully inserted under ultrasound guidance. Seldinger technique was used in the first attempt without any resistance. Reflux was observed in all ports, confirming the correct position of the central venous catheter. Ultrasound further 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 hemodynamics throughout and during surgery with ventilation settings of Vt 400mL, RR 12bpm, and PEEP 3cmH2O. Surgical position herringbone + 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 volume 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 immediately 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 wasx 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.

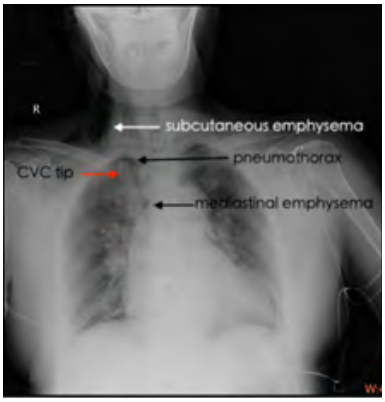

Figure 1: Bedside chest X-ray（the day of the surgery）：Right-sided pneumothorax and mediastinal emphysema.

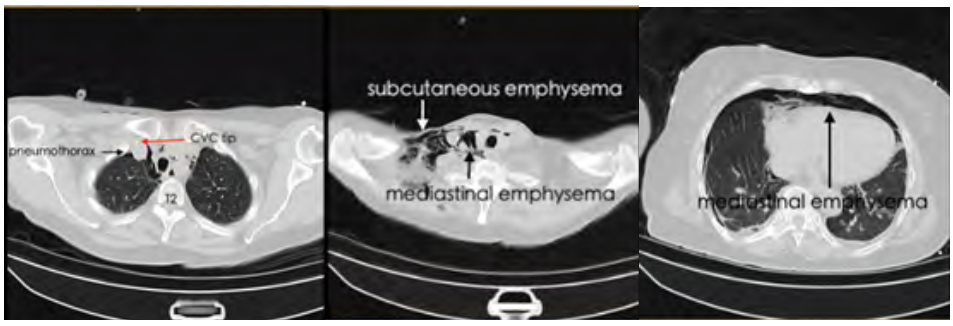

Figure 2: Chest CT（the day of the surgery）: Right-sided pneumothorax, subcutaneous emphysema, mediastinal emphysema, and the tip of the CVC was partially extravascular.

Figure 3: Bedside chest X-ray (2 days after the surgery）: pneumothorax, subcutaneous emphysema and mediastinal emphysema were absorbed.

4. Discussion

Pneumothorax most often occurs with increased subclavian vein puncture routes and attempts at puncture. Mediastinal emphysema is free gas in the mediastinal cavity that can diffuse along the tissue planes, leading to subcutaneous emphysema and pneumothorax. CO2 pneumoperitoneum is an independent risk factor for mediastinal emphysema during surgery [7]. In this case an ultrasound guided IJV catheterization on the first puncture. This catheter completed intravenous sequential induction intraoperative fluid infusion and anesthesia maintenance, and the tip of the catheter was found to have broken out of the vein wall after laparoscopic radical surgery for transverse colon cancer, which was combined with a right pneumothorax, subcutaneous emphysema, and mediastinal emphysema. In this case report, the intraoperative finding of a transverse colon tumor invading the liver, combined with imaging suggesting a greater amount of mediastinal emphysema than pneumothorax, we suspected that the mediastinal emphysema might have been caused by rupture of the diaphragm during intraoperative manipulation in the vicinity of the diaphragm. This rare, delayed pneumothorax suggests that the position of the catheter tip may be affected by changes in body position even if the operation is smooth during puncture. According to studies, changes in body position and even respiratory movements can play a role in CVC displacement [8, 9]. When the external segments of the catheter were sutured to the subcutaneous tissue and the patient was changed from a supine to an upright position, the mediastinal structures lengthened and the abdominal organs descended, resulting in cephalad pulling of the head end of the catheter relative to the right atrium. Conversely, when the patient, in this case, was changed from supine to a head-down position with CO2 pneumoperitoneum, the catheter tip approached the right atrium at an angle to the vessel wall and even punctured the vessel wall. Current guidelines issued by the European Society of Anesthesiology (ESA) and the American Society of Anesthesiology (ASA) recommend the use of intracavitary electrocardiography (IC-ECG) for CVC tip localization [10, 11]. This current gold standard for catheter tip control helps identify secondary malposition. When intracardiac ECG is not applicable, 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.

6. Acknowledgment

Financial support and sponsorship: Anesthesiology-Key academic discipline of Tongren Hospital (tr2023xk0901). Changning District Health and Wellness Committee Research Program (20214Y009) Exploring the effects of dexamethasone on pathological pain-induced anxiety-depression-like behavior based on inflammatory NLRP3.

References

1. Beheshti MV. A concise history of central venous access. Tech Vasc Interv Radiol. 2011; 14(4): 184-185.
2. Research i. Central Venous Catheter Market Size, Share & Trends Analysis, Global. 2020; 2026: 2020.
3. Boulet N, Muller L, Rickard CM, Lefrant JY, Roger C. How to improve the efficiency and the safety of real-time ultrasound-guided central venous catheterization in 2023: a narrative review. Ann Intensive Care. 2023; 13(1): 46.
4. Parienti JJ, Mongardon N, Mégarbane B, Mira JP, Kalfon P, Gros A. Intravascular Complications of Central Venous Catheterization by Insertion Site. N Engl J Med. 2015; 373(13): 1220-1229.
5. Teja B, Bosch NA, Diep C, Pereira TV, Mauricio P, Sklar MC. Complication Rates of Central Venous Catheters: A Systematic Review

and Meta-Analysis. JAMA Intern Med. 2024; 184(5): 474-482.

6. Patel AR, Patel AR, Singh S, Singh S, Khawaja I. Central Line Catheters and Associated Complications: A Review. Cureus. 2019; 11(5): e4717.
7. Murdock CM, Wolff AJ, Van Geem T. Risk factors for hypercarbia, subcutaneous emphysema, pneumothorax, and pneumomediastinum during laparoscopy. Obstet Gynecol. 2000; 95(5): 704-709.
8. Pan PP, Engstrom BI, Lungren MP, Seaman DM, Lessne ML, Kim CY. Impact of phase of respiration on central venous catheter tip position. J Vasc Access. 2013; 14(4): 383-387.
9. Roldan CJ, Paniagua L. Central Venous Catheter Intravascular Malpositioning: Causes, Prevention, Diagnosis, and Correction. West J Emerg Med. 2015; 16(5): 658-664.
10. Lamperti M, Biasucci DG, Disma N, Pittiruti M, Breschan C, Vailati D. European Society of Anaesthesiology guidelines on peri-operative use of ultrasound-guided for vascular access (PERSEUS vascular access). Eur J Anaesthesiol. 2020; 37(5): 344-376.
11. Practice Guidelines for Central Venous Access 2020: An Updated Report by the American Society of Anesthesiologists Task Force on Central Venous Access. Anesthesiology. 2020; 132(1): 8-43.
12. Fletcher SJ, Bodenham AR. Safe placement of central venous catheters: where should the tip of the catheter lie? Br J Anaesth. 2000; 85(2): 188-191.
13. Gorski LA. The 2016 Infusion Therapy Standards of Practice. Home Healthc Now. 2017; 35(1): 10-18.
14. Peres PW. Positioning central venous catheters--a prospective survey. Anaesth Intensive Care. 1990; 18(4): 536-539.
15. Şahinkaya HH, Parlak M, Tekgul ZT. Assessment of the Tip Position of Central Venous Catheters Inserted Using Peres' Height Formula. Cureus. 2022; 14(11): e31988.