



Case report

Hydromediastinum and hydrothorax as delayed complications of peripherally inserted central catheter used for total parenteral nutrition: A case report

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ABSTRACT

Introduction: Central venous catheters (CVCs) and peripherally inserted central catheters (PICCs) may cause delayed complications, such as venous erosion, hydrothorax, or hydromediastinum. Vascular erosion is most frequently associated with left-sided CVC insertions. We report a case of hydropneumomediastinum and hydropneumothorax as a delayed complication of right-sided PICC used for total parenteral nutrition.

Presentation of case: A 77-year-old man with muscle-invasive urothelial bladder cancer underwent pelvic lymphadenectomy and radical cystectomy with uretero-ileostomy reconstruction (Bricker). The patient developed postoperative ileus, and thus, a right PICC was inserted for total parenteral nutrition. On postoperative day 8, he developed bilateral hydromediastinum, and bilateral thoracentesis was performed. After the procedure, he presented with respiratory and hemodynamic deterioration and was transferred to the intensive care unit for 12 days. The patient was eventually discharged and followed-up at the outpatient department.

Discussion: Ruptured SVC has been predominantly described in left-sided CVCs at the right angle of the junction of the left brachiocephalic vein and SVC. However, our patient is the second documented case of bilateral hydropneumothorax and hydropneumomediastinum as a delayed complication of a PICC used to administer total parenteral nutrition. Catheters may migrate from their initial position due to breathing, bloodstream flow dynamics, postural rotation, and neck movements. Chemical irritation of the vessel wall may be caused by hyperosmolar hyperalimentation fluid.

Conclusion: A right-sided vascular approach is preferred to avoid friction complications, and the tip should be placed at the lower third of the vena cava to prevent vascular erosion.

1. Introduction

Central venous catheters (CVCs) and peripherally inserted central catheters (PICCs) are the most commonly used equipment in gastrointestinal surgical theatres. The central line is required in patients on repeated intermittent drug therapy, regular transfusions, total parenteral nutrition (TPN), and chemotherapy [1–4]. However, CVC and PICC may cause several complications, such as pneumothorax and arterial punctures, during the insertion procedure, as well as delayed complications, such as infection, thrombosis, fracture and embolization, catheter migration, venous erosion, and hydrothorax or hydromediastinum [5–7]. According to previous reports, vascular erosions are most

commonly associated with left-sided CVC insertions used in intensive care units to administer fluids, medications, and blood products [5,8,9]. Here, we describe a rare case involving hydropneumomediastinum and hydropneumothorax as a delayed complication of right-sided PICC used for TPN.

The purpose of this review was to present one of the most common complications after PICC insertion and to expose the actions that should be taken to prevent this complication.

This case report is in line with the surgical case report (SCARE) criteria [10].

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2. Presentation of case

A 77 years-old man (height, 165 cm; weight, 56 kg) with muscle-invasive urothelial bladder cancer was admitted for pelvic lymphadenectomy and radical cystectomy with uretero-ileostomy (Bricker) reconstruction. The patient developed postoperative ileus. A right peripherally inserted venous catheter was canalized, and TPN was initiated. An experienced nurse placed the catheter. However, catheter insertion was difficult, but the blood was still freely aspirated through the catheter. We confirmed that the catheter tip was placed at the upper third of the vena cava (Fig. 1), and TPN was initiated through the catheter.

On postoperative day 8, chest pain, right upper limb pain, parasternal edema, and supraclavicular edema occurred. Acute myocardial infarction was ruled out. Three days later, thoracic computed tomography (CT) scan showed bilateral pleural effusion and mediastinal hematoma (Fig. 2). Considering these findings, bilateral thoracentesis was performed, yielding 2000 ml of thin milky fluid that appeared to be identical to the patient's hyperalimentation fluid. TPN infusion was terminated, and the PICC was removed.

After the procedure, the patient presented respiratory and hemodynamic deterioration; was intubated and administered vasopressor support; and was eventually transferred to the intensive care unit. Vancomycin-resistant *Enterococcus faecium* was isolated in the pleural fluid culture, and blood culture revealed *Candida albicans*. On the ninth day, the patient was weaned from mechanical ventilation. On the twelfth day, he was transferred to the hospital ward room to continue his rehabilitation process. The patient was eventually discharged and followed-up at the outpatient department.

3. Discussion

CVC and PICC may cause certain complications that can be divided into two categories: immediate and delayed [1,2,11]. Delayed complications are related to prolonged catheter use, including cardiac tamponade, catheter-related infection, unilateral and bilateral hydrothorax, and hydromediastinum [2,12–16]. However, these complications have been predominantly described in left-sided CVCs, and only two articles reported vascular erosion as a complication of the inserted central venous catheter for TPN [9,17]. To our knowledge, this report describes

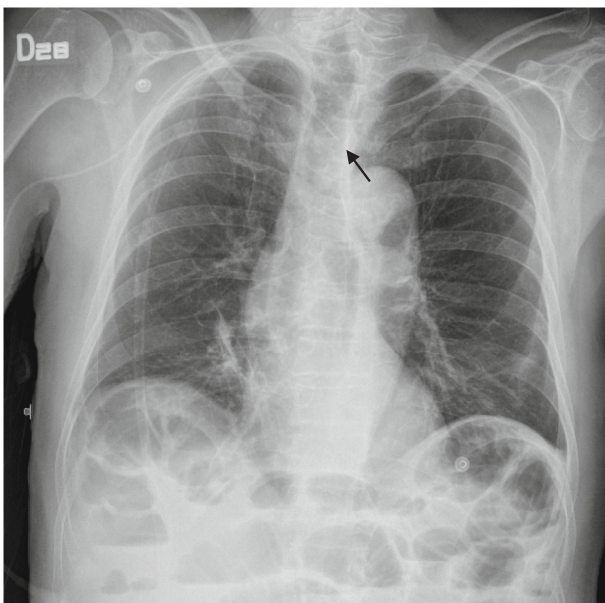


Fig. 1. Chest radiograph following the right PICC placement. Note the position and angle of the catheter tip (arrow).

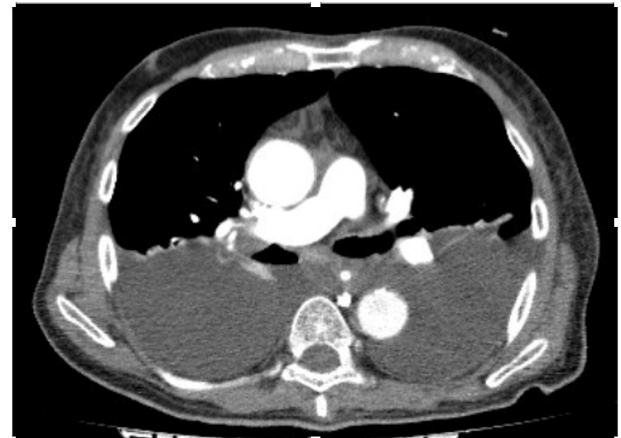


Fig. 2. Thoracic CT scan taken 3 days after the occurrence of chest pain. Note the bilateral pleural effusion and mediastinal hematoma.

the second documented case of bilateral hydrothorax and hydromediastinum as delayed complications of a PICC used for TPN administration.

Hydrothorax and hydromediastinum are delayed complications with an incidence of 0.17% [9], usually present when a central venous catheter is inserted to infuse chemotherapy, rapid volume expanders, drug therapy, and regular transfusions [1]. Placement of the CVC through the left side predisposes rupture through the SVC due to the nearly right angle at the junction of the left brachiocephalic vein and SVC, placing the catheter tip in a perpendicular angle with respect to the SVC [9].

In this case, although the PICC was placed through the right peripheral vein and the radiograph taken immediately after placing the catheter confirmed that the tip was placed at the middle third of the vena cava, the catheter tip was located perpendicular to the medial wall of the SVC. Therefore, a vein was ruptured by the catheter tip, causing the hydromediastinum and accumulation of fluid in this space. The fluid may have eroded the mediastinal pleura and caused hydrothorax. In retrospect, it would have been safer to advance the catheter further into the superior vena cava so that its tip would lie parallel to the long axis of the SVC, thus minimizing mechanical forces on the wall of the vein.

The catheter tip, while in a good position on initial X-ray, may also possibly move with respiration, bloodstream flow dynamics, postural rotation, and neck movements, which may result in catheter migration to a sharper angle that abuts the blood vessel wall.

The type of fluid infused and parenteral nutrition may cause intimal injury. Chemical irritation of the vessel wall caused by hyperosmolar hyperalimentation fluid and the abutment of the catheter tip at a perpendicular angle with respect to the SVC, as could have happened in this patient, are contributing factors for the erosion of the venous wall [9].

4. Conclusion

In conclusion, unilateral or bilateral hydrothorax and hydromediastinum are delayed complications that may also occur when a peripherally central catheter is used for TPN administration. The incidence of vascular erosion was greater in left-side lines. Proximal positioning of the tip carries the risk that the catheter will lie at a more acute angle, increasing the likelihood of venous perforation. Therefore, a right-sided vascular approach is preferred to avoid friction because of the acute anatomical angle of the SVC. During the evaluation of post-insertion chest radiograph, particular attention should be paid to catheter position, ensuring that the tip is placed at the inferior third of the vena cava and is not in contact with the SVC walls.

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Ethical approval

We have approval from The Ethics Committee of the Faculty of Medicine, Pontificia Universidad Javeriana.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Registration of research studies

This study didn't require registration.

Guarantor

Saul J. Rugeles, MD.

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CRedit authorship contribution statement

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Declaration of competing interest

The author has no conflict of interest to declare.

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