SAGE Open Medical Case Reports
Volume 11: 1–4

DOI: 10.1177/2050313X221147421
journals.sagepub.com/home/sco
SAGE

Total parenteral nutrition pleural effusion after peripherally inserted central venous catheter insertion despite fluoroscopic confirmation

Michael Yang[1] and Angelena Lopez[2]

Abstract

Peripherally inserted central catheters are frequently used for durable central venous access for nutrition. Depending on the medical and surgical history, there are times when a person's vasculature has become scarred or stenotic due to multiple previous vascular devices, catheters, or pacemaker/defibrillator leads, that causes placement of a peripherally inserted central catheter challenging. Choosing the correct catheter and approach must be weighed against invasiveness of the procedure as unforeseen complications can arise. When pleural effusions quickly accumulate after placement of a peripherally inserted central catheter despite using confirmatory image guidance, delayed complications must be thought of, and offending medications and catheter should be removed in a timely fashion to avoid further morbidity and mortality.

Keywords

Critical care, radiology, total parenteral nutrition pleural effusion, pleural effusion, total parenteral nutrition, peripherally inserted central catheter, peripherally accessed central catheter, fluoroscopy

Date received: 23 September 2022; accepted: 8 December 2022

Introduction

Peripherally inserted central venous catheters (PICCs) are commonly used and is a safe method of achieving central venous access for patients who require a wide range of access needs, including frequent blood draws, transfusions, vasopressors, antibiotics infusion, chemotherapy and total parenteral nutrition (TPN), to name a few.[1–3] They are typically placed with intent for medium to longer term use (4–6 weeks or longer).[4] At our institution, we place PICC lines with ultrasound, magnetic tracking and electrocardiogram guidance by expertly trained providers at the bedside.[2,5] They can also be placed with ultrasound and fluoroscopic guidance when a patient's vasculature and access history is complicated. Immediate complications include vascular injury, arterial puncture, bleeding, phlebitis and catheter malposition.[2,3] More common delayed complications include dislodgement, thrombosis/venous thromboembolism and infection.[6,7] Rarely, vascular erosion, pleural effusion, hydromediastinum, hemothorax, pericardial effusion, or catheter fracture and migration may occur.[8,9] The incidence of vascular erosions and hydrothorax is very rare at 0.17%, and although difficult to define in the adult population, the incidence of PICC-related TPN pleural effusion is reported to be 0.4% in the pediatric and neonatal population.[9,10] We present a case in which an adult patient had rapidly progressing bilateral pleural effusions caused by vascular erosion and leakage without significant vein trauma after PICC placement despite with fluoroscopic guidance.

Case report

An 80-year-old female with amyloid light chain (AL) amyloidosis, complicated by bowel resection, short gut syndrome and severe protein malnutrition was seen for vascular access due to need for TPN. Her medical history was complicated by chronic diastolic heart failure requiring

[1]Procedure Center, Internal Medicine, Department of Medicine, Cedars-Sinai Medical Center, Los Angeles, CA, USA
[2]Procedure Center, Pulmonary Critical Care, Department of Medicine, Cedars-Sinai Medical Center, Los Angeles, CA, USA

Corresponding Author:
Michael Yang, Procedure Center, Internal Medicine, Department of Medicine, Cedars-Sinai Medical Center, Los Angeles, CA 90048, USA.
Email: michael.yang2@cshs.org

implantable cardioverter-defibrillator (ICD) implantation via the right subclavian vein. She had a chronic left upper extremity and subclavian venous stenosis and blockage which precluded left sided ICD implantation in the past. She had known recurrent bilateral transudative pleural effusions that had been managed with repeated thoracenteses, the etiology of which was thought due to her underlying heart failure. The patient required durable central venous access for TPN administration and lab draws. The procedure team presented options given her complex vascular history, which included PICC insertion via the (left or right) arm and tunneled central venous catheter insertion via the internal jugular veins (left or right). After discussing the risks and benefits with the patient and her daughter, and despite the non-optimal vasculature for a PICC, they preferred to attempt PICC given the less invasive nature and morbidity related to patient's age, thin stature and fragility, compared to the tunneled central venous catheter.

A PICC insertion was attempted via the left brachial vein. Ultrasound (Sonosite Edge II; Fujifilm Sonosite, Bothell, WA, USA) and catheter tip tracking (Sherlock-3CG™; BD, Franklin Lakes, NJ, USA) guidance were used at the very start given her complex anatomy. During the procedure, a double lumen catheter (PowerPICC™; BD, Franklin Lakes, NJ, USA) could not be passed beyond 22 cm, consistent with previously suspected left subclavian blockage. The catheter was removed, and procedure aborted. The next day, PICC insertion was re-attempted with ultrasound and fluoroscopic guidance in the procedural suite. The right brachial vein was successfully cannulated using ultrasound (Sonosite Edge II; Fujifilm SonoSite) guidance. Different guidewires ranging from 0.016″ to 0.018″ were passed into the vein but met significant resistance in the mid- to proximal subclavian vein likely due to the presence of dual ICD leads. Eventually, a 0.025″ hydrophilic coated angled Glidewire® (Terumo Interventional Systems) was able to be traversed into the distal to mid-superior vena cava (SVC). A 5-Fr single lumen PICC catheter (PowerPICC™, BD) was inserted over this Glidewire® and carefully advanced as far as possible, ending at the distal SVC near the junction with the right brachiocephalic vein. Catheter tip was visualized pointing downward on fluoroscopy and was able to aspirate and flush without issue. We were satisfied with location and placement of this catheter for TPN use and elected to abort further attempts due to patient's ongoing discomfort and family's preference to avoid further invasive procedures (Figure 1).

Following placement of the PICC into the right brachial vein, the patient was started on TPN. She became progressively hypoxic with worsening respiratory failure over the next 4 days. Chest x-ray showed a large right pleural effusion and moderate left pleural effusion. The tip of the PICC had also migrated slightly back into the right subclavian vein from the junction of the right brachiocephalic vein and the SVC (Figure 2). The patient was transferred to the Medical Intensive Care Unit and intubated for respiratory failure.

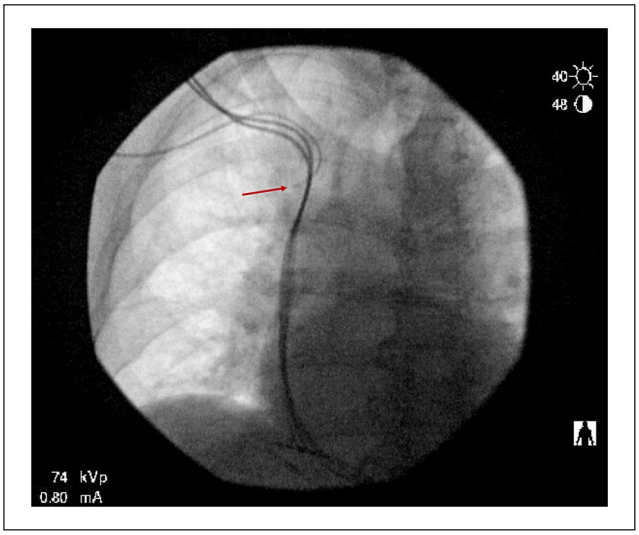

Figure 1. Fluoroscopic imaging showing position of PICC (red arrow) at the distal SVC.

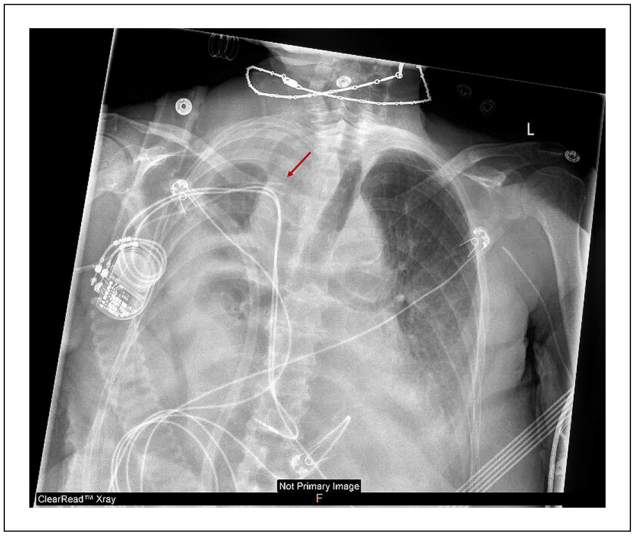

Figure 2. Enhanced chest x-ray of PICC (red arrow) showing slight migration back into right brachiocephalic vein and enlarging right pleural effusion.

Bilateral thoracenteses were performed using a 6 Fr Safe-T-Centesis™ (Medline Industries) catheter. From the right hemithorax, 1500 mL of milky white fluid was removed. Fluid analysis showed minimal red blood cells, 956 white blood cells (91% polymorphonuclear leukocytes, 9% monocytes), with chemistry showing glucose of 297 mg/dL (serum 190 mg/dL), lactate dehydrogenase (LDH) of 56 units/L (serum 170 units/L), protein of 9.9 g/dL (serum protein 3.2 g/dL) and triglyceride of 1161 mg/dL (serum 141 mg/dL). From the left hemithorax 900 mL of milky white fluid was removed with fluid analysis showing similar results and notable for triglyceride of 1180 mg/dL, protein of 6.4 g/dL,

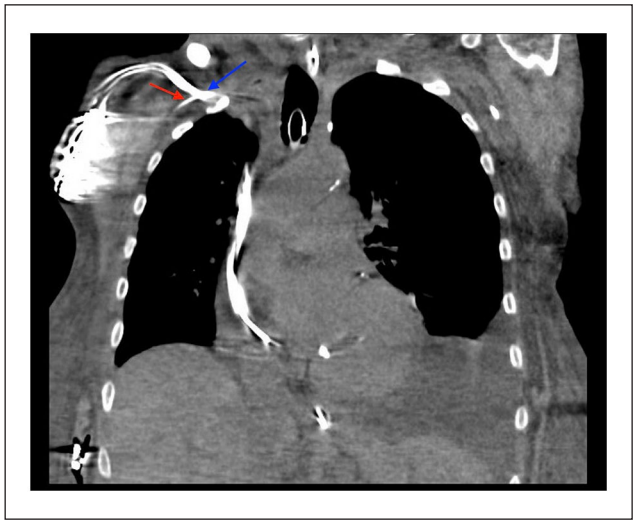

Figure 3. CT chest showing PICC position (red to blue arrows) crossing paths with dual ICD leads inside the right subclavian vein.

glucose of 106 mg/dL and LDH of 107 units/L. The patient was stabilized over the next day and repeat chest x-ray showed significantly decreased pleural effusions. A non-contrast computerized tomography chest was done and the tip of the PICC was at the junction of the right subclavian vein and the right brachiocephalic vein (Figure 3). The dual ICD leads pass just inferior to the PICC and then their respective anchoring points in the right atrium and right ventricle. TPN was stopped at this point and the PICC was removed without complications. The patient's pleural effusion started to resolve over the next several days. Eventually, a tunneled central venous catheter was placed using the left internal jugular venous approach with ultrasound and fluoroscopic guidance. The procedure was uncomplicated, and patient was discharged to a skilled nursing facility on TPN. One and a half months later at discharge, chest x-ray showed stable small bilateral pleural effusions.

Discussion

This case demonstrates a rare case of bilateral TPN pleural effusions as a delayed complication of PICC placement in an adult patient. The effusions were milky and with severely elevated triglycerides, narrowing the differential to TPN effusions or chylothoraces. In this patient with a history of AL amyloidosis and recent administration of TPN, both etiologies were possible. Systemic amyloidosis is associated with persistent pleural effusions in 1%–2% of patients due to amyloid infiltration of the pleural lining and impaired parietal pleural drainage.[11] In rare instances, and usually associated with late-stage amyloidosis, unilateral or bilateral chylothoraces can develop.[12] Both TPN effusions and chylous effusions will have high triglycerides and can have a characteristic milky appearance. However, glucose and electrolyte concentrations in the pleural fluid will differ significantly between the two. While chyle will lack high quantities of glucose and electrolytes, these should both be present in TPN effusions.[13,14] A useful calculation is comparison of pleural fluid glucose to serum glucose, with a ratio >1 suggestive of an infusion fluid etiology.[8,14] In a patient receiving or recently receiving TPN, this, in conjunction with the elevate triglyceride level and milky appearance of the pleural fluid are diagnostic of TPN medicate effusion. In this case, resolution of the effusion after removal of the PICC further supported the diagnosis.

There have been only a few cases (more in neonates than adults) of TPN-related pleural effusion as a complication after PICC placement.[15,16] In our situation, despite in working order, the PICC could have caused micro-trauma to the smaller subclavian and brachiocephalic veins leading to erosion.[17] In addition, having hyperosmolar fluid such as TPN infused with a pump can lead to breakdown of the endothelium further leading to seepage of TPN into the pleural spaces.[16] Given there is minimal red blood cells (RBCs) and no hemothorax, there is unlikely any macroscopic venous puncture or vein laceration and tear. The existing dual ICD leads traversing the subclavian vein can likely cause stenosis and scarring of the vein, making placement difficult, leading to multiple attempts with different guidewires, which could have further traumatized or irritated the intima of the vein.[17] Even rarer, the bilateral nature of TPN effusions in this case further supports vascular erosion into the mediastinal space, and then, extension into the pleural spaces. Finally, the choice of placing a PICC in the setting of complex venous anatomy, vascular access history, can lead to unforeseen complications and morbidity. In this case, a tunneled central venous catheter would have been a more straightforward choice from the start despite patient and family preferences.

Conclusion

Complicated procedures that require multiple attempts increase the risk of immediate and delayed complications. The potential risks posed by pre-existing conditions not usually present must be weighed against alternative procedures despite invasiveness and patient preferences. Temporal recognition of pleural effusions after PICC placement is important as it can clue in on the cause of the effusion, especially in such setting. Non-optimal position of the tip of catheters must be promptly recognized and addressed. Fluid appearance and biochemical analysis are central to determining the etiology, especially in patients with multiple co-morbid medical conditions that are associated with pleural involvement. Despite being very rare, one should always be cognizant of pleural effusions caused by infusate (TPN in our case) into the pleural space. Prompt cessation of TPN, removal of PICC and thoracentesis are necessary to treat resultant respiratory failure and prevent further morbidity and mortality. A study of peripheral vascular access summed up well in

regard to vascular access: one should always be thinking to "choose the right device, for the right vein, with the right therapy, for the right duration and for the right patient."[18,19]

Author contributions

Michael Yang: Writing of main article, figures, abstract, editing, revision.
Angelena Lopez: Writing of main article and editing.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

Ethics approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed consent

Written informed consent was obtained for the publication of this case report. It was obtained from patient's daughter (legal representative). The reason consent was obtained from patient's daughter retrospectively is due to patient being deceased at the time of writing of this article.

ORCID iD

Michael Yang https://orcid.org/0000-0002-0080-0206

References

1. Ng PK, Ault MJ, Ellrodt AG, et al. Peripherally inserted central catheters in general medicine. *Mayo Clin Proc* 1997; 72(3): 225–233.
2. Johansson E, Hammarskjöld F, Lundberg D, et al. Advantages and disadvantages of peripherally inserted central venous catheters (PICC) compared to other central venous lines: a systematic review of the literature. *Acta Oncol* 2013; 52(5): 886–892.
3. Bahoush G, Salajegheh P, Anari AM, et al. A review of peripherally inserted central catheters and various types of vascular access in very small children and pediatric patients and their potential complications. *J Med Life* 2021; 14(3): 298–309.
4. Chopra V, Flanders SA, Saint S, et al. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): results from a multispecialty panel using the RAND/UCLA appropriateness method. *Ann Intern Med* 2015; 163: S1–S39.
5. Mack V, Nissler D, Kasikci D, et al. Magnetic tracking and electrocardiography-guided tip confirmation system versus fluoroscopy for placement of peripherally inserted central catheters: a randomized, noninferiority comparison. *Cardiovas Intervent Radiol* 2020; 43: 1891–1897.
6. Fallouh N, McGuirk HM, Flanders SA, et al. Peripherally inserted central catheter-associated deep vein thrombosis: a narrative review. *Am J Med* 2015; 128(7): 722–738.
7. Mavrovounis G, Mermiri M, Chatzis DG, et al. Peripherally inserted central catheter lines for intensive care unit and oncohematologic patients: a systematic review and meta-analysis. *Heart Lung* 2020; 49(6): 922–933.
8. Duntley P, Siever J, Korwes ML, et al. Vascular erosion by central venous catheters. Clinical features and outcome. *Chest* 1992; 101: 1633–1638.
9. Walshe C, Phelan D, Bourke J, et al. Vascular erosion by central venous catheters used for total parenteral nutrition. *Intensive Care Med* 2007; 33(3): 534–537.
10. Bashir RA, Callejas AM, Osiovich HC, et al. Percutaneously inserted central catheter-related pleural effusion in a level III neonatal intensive care unit: a 5-year review (2008–2012). *JPEN J Parenter Enteral Nutr* 2017; 41(7): 1234–1239.
11. Berk JL, Keane J, Seldin DC, et al. Persistent pleural effusions in primary systemic amyloidosis: etiology and prognosis. *Chest* 2003; 124(3): 969–977.
12. Chen JY, Li WT, Hsu CH, et al. Chylous ascites and chylothorax: an unusual manifestation of cardiac amyloidosis. *Intern Med* 2010; 49(16): 1763–1766.
13. Wolthuis A, Landewé RB, Theunissen PH, et al. Chylothorax or leakage of total parenteral nutrition? *Eur Respir J* 1998; 12: 1233–1235.
14. Hong S, Kim SH, Lee HK, et al. Extravasation of TPN following central venous catheter migration. *Respir Med Case Rep* 2022; 37: 101623.
15. Kumar J, Sudeep KC, Mukhopadhyay K, et al. A misplaced peripherally inserted central catheter presenting as contralateral pleural effusion. *BMJ Case Report*. Epub ahead of print 17 April 2018. DOI: 10.1136/bcr-2018-224471.
16. Diaz M, Lorda I, Sanchez C, et al. Milky-white pleural effusion complicating peripherally inserted central venous catheter for total parenteral nutrition. *Eur J Clin Nutr* 2005; 59: 302–303.
17. Blackwood BP, Farrow KN, Kim S, et al. Peripherally inserted central catheters complicated by vascular erosion in neonates. *JPEN J Parenter Enteral Nutr* 2016; 40(6): 890–895.
18. Steere L, Ficara C, Davis M, et al. Reaching one peripheral intravenous catheter (PIVC) per patient visit with lean multimodal strategy: the PIV5RightsTM bundle. *J Assoc Vasc Access* 2019; 24: 331–343.
19. Van Rens MFPT, Paramban R, Francia ALV, et al. Evaluation of a diluted lipid emulsion solution as a lubricant for improved peripherally inserted central catheter guidewire removal in a neonatal population. *BMC Pediatrics* 2022; 22: 71.