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Chylothorax and mediastinal haematoma by central venous catheter post-duodenal ulcer and pyloroplasty surgery: a case report

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Abstract

In handling critically ill patients, central venous catheterization is a fundamental procedure. Incidence of pleural effusion and mediastinal haematoma following central venous placement is rare, with a rate between 0.17% and 1%. We report a frail elderly man who was started on parenteral nutrition administered by left internal jugular vein catheter post-emergency laparotomy surgery for a perforated duodenal ulcer. He developed bilateral chylothorax immediately on the first day of parenteral nutrition supplement. Contrast-enhanced computed tomography of the thorax as part of chylothorax workouts incidentally revealed anterior mediastinal haematoma in communication with the catheter tip, implying likely an iatrogenic injury. Rapid onset of chylothorax may indicate a thoracic duct injury and concurrent parenteral nutrition content leakage from the extravasated catheter. The anatomical connection between the pleural and mediastinal cavities has not been clearly illustrated in the literature. Bilateral chest drains were inserted and the catheter was removed at bedside without complications. Despite using ultrasound guidance, clinical methods and post-procedure chest X-ray, the catheter malposition was not detected before initiation of parenteral nutrition. The learning point is for the clinician to remain vigilant for potential catheter-related complications.

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Introduction

Since the introduction of the central venous catheter (CVC) on the battlefield in 1952, CVC has become an essential route of venous access in clinical practice, especially in critically ill patients for fluids, medications, and parenteral nutrition (PN) as well as for hemodynamic monitoring.

The CVC insertion site selection is determined by clinical indications and practitioner expertise. The upper body site is favoured over the femoral site due to the lower infection risk. Insertion is invasive and associated with complications, which are categorized as related to catheter insertion, indwelling, and extraction.[1] Catheter-related complications include carotid artery punctuate, pneumothorax, through and through cannulation, tracheal injury, air embolism, catheter malposition, bloodstream infection, and thrombosis. Chylothorax is a rare complication.[2] Mediastinal haematoma is also uncommon.[3] It can be fatal if the haematoma expands. Even rarer is the occurrence of concurrent chylothorax and mediastinal haematoma.

Local precaution checklists are recommended, which include strict aseptic technique, presence of an assistant, ultrasound guidance, clamping the guidewire during catheter advancement, and shouting when the guidewire is removed. Ultrasound has reduced the incidence of immediate complications from 11.8 % to 4–7%.[4] CVC is commonly inserted in emergency surgery for intraoperative and postoperative use. Post-laparotomy bowel surgery patients often need prolonged vascular access for PN.

Case presentation

A 68-year-old retired Malay elderly with long-standing type 2 diabetes mellitus and hypertension was initially admitted under surgical team for urosepsis secondary to the right emphysematous pyelonephritis with right perinephric and pararenal collections. He was completely dependent in daily activities due to a recent stroke. He had Forrest IIc gastric ulcer. After 10 days course of intravenous (IV) piperacillin-tazobactam targeted for *Enterobacter cloacae* yield from the pelvic collections, he was discharged home with percutaneous drains at both flanks.

He was readmitted the next day with hypovolemic shock from melaena and anaemia-induced angina. A haemoglobin drop of 6 g/dL was reported. Despite adequate fluid resuscitation, he required IV noradrenaline infusion. He was given IV esomeprazole infusion and kept fasted for oesophageal-gastro-duodenoscopy (OGDS). His bleeding Forrest Ib ulcer ulcer at the first part of the duodenum was secured. Recurrent hypovolemic shock with massive melaena prompted a second OGDS within 24 hours. OGDS revealed an oozing spot at the previous ulcer site and bleeding was secured. Eight pints packed cell and one cycle of disseminated intravascular coagulation regime were transfused. However, due to persistent melaena an emergency pylorotomy, underrunning of duodenal ulcer, and pyloroplasty surgery were performed under general anaesthesia with intraoperative findings of Forrest Ia ulcer at part one and two of the duodenal junction.

A left internal jugular vein (IJV) CVC with 7 French quadruplet lumens was inserted preintubation under ultrasound guidance in a single attempt without immediate complications. The patient's coagulation profile and platelet count were within the normal range. No antiplatelet or anticoagulant medications were used on the patient. A left IJV was chosen as he had a 16G branula inserted in the right neck for inotrope use. The catheter was used for inotrope administration and electrolyte correction during surgery. Postoperatively, the patient was weaned in the intensive care unit. A post-procedure chest X-ray showed the CVC tip at the left innominate vein with no adjustment done. Starting the second postoperative day, the catheter was used to administer PN.

On the same day, computerized tomography (CT) of the abdomen and pelvis performed to assess the pelvic collections revealed bilateral moderate pleural effusion as an incidental finding. CT angiography of the abdomen conducted after 48 hours to identify any active intra-abdominal bleeding showed persistent pleural effusion. The patient was not ready for enteral nutrition; as such, PN was continuously delivered via the catheter. As he developed acute on chronic kidney disease with hyperuriceamia, a right IJV double-lumen was inserted later for intermittent haemodialysis.

His condition improved, but he failed a spontaneous breathing trial (SBT) and had persistent leucocytosis. The bilateral pleural effusion could have contributed to the failure of SBT (Fig. 1). A right chest drain was inserted for diagnostic and therapeutic purposes. The pleural fluid had biochemical characteristics consistent with aseptic and uncomplicated chylothorax (Table 1). Hence, the catheter was discontinued. A right femoral CVC was inserted for the continuation of PN.

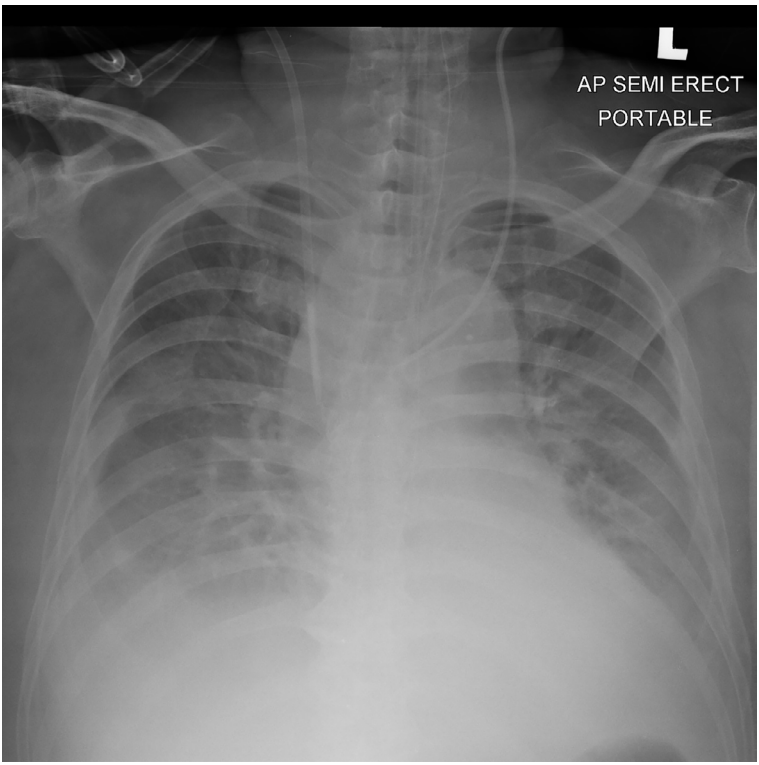

Fig. 1. AP chest X-ray taken in semierect position on day 4 post-left internal jugular vein (IJV) central venous catheter (CVC) insertion and immediately post-right IJV double lumen catheter insertion. Greater bilateral pleural effusion is seen on the right side than in the left side. The left CVC tip was at the left innominate vein. The right double lumen tip was in the lower third of the superior vena cava.

The case was referred to the respiratory team for the likely traumatic chylothorax post left IJV CVC insertion. CT of the thorax revealed a large anterior mediastinal haematoma communicating with the left IJV CVC tip (Fig. 2, left). Bilateral pleural effusion was also noted (Fig. 2, right). Right thoracoscopy was performed under general anaesthesia to rule out pleural pathology. Pleural biopsy found no malignant cells. Intraoperative findings were minimal anthracosis and whitish pleural thickening. In our centre, lymphangiography was not avaialble to rule out thoracic duct injury or leak.

Table 1. Bilateral pleural fluid results

Parameters	Right pleural fluid (3/12/21)	Serum	Left pleural fluid (10/12/21)	Serum
Cholesterol (mmol/L)	< 0.5	2.8	0.56	1.6
Triglycerides (mmol/L)	14 (> 1.1 mmol/L)	N/A	13.3 (> 1.1 mmol/L)	1
pH	8 (Uncomplicated)		8 (Uncomplicated)	
Appearance	Milky		Milky	
Glucose (mmol/L)	10.9	8.8 (PSR 1.2)	4.4	6.3 (PSR 0.7)
Protein (g/L)	<30	39 (PSR N/A)	< 30	48 (PSR N/A)
LDH (U/L)	400	386 (PSR 1.0)	754	309 (PSR 2.4)
Microbiology test	Negative	N/A	Negative	N/A

LDH: PSR: pleural to serum ratio; N/A: not applicable

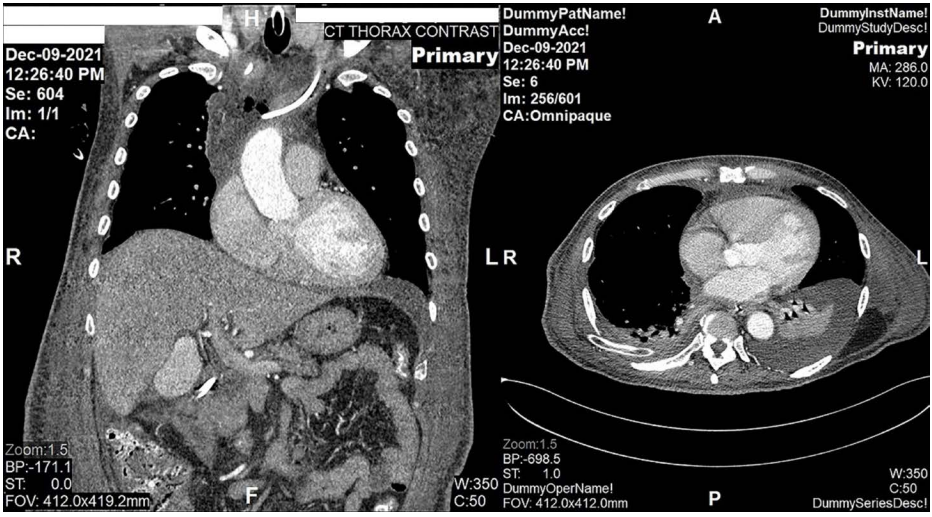

Fig. 2. (*Left*) Computed tomography (CT) of the thorax (coronal view) showing anterior mediastinal haematoma with intervening air pockets. This collection measured approximately 3.9 x 8.7 x 13.1 cm (AP x W x CC) . The distal tip of the left internal jugular catheter is seen to be extravascular and within the mediastinal haematoma. (*Right*) CT of the thorax (axial view) showing bilateral pleural effusion (moderate on the left and minimal on the right), with adjacent collapsed consolidation of the whole lower left lobe.

A left chest drain was inserted to reduce mediastinal collection size. The pleural fluid features on the left were consistent with those of the right. The vascular team was referred. They decided to remove the extravasated CVC at bedside, with an interventional radiologist and a cardiothoracic surgeon on standby in anticipation of an expanding mediastinal haematoma due to the loss of compression haemostasis of the catheter. It was performed without immediate complications.

The patient was extubated and transferred to ward the next day. In the ward, enteral feeding was established. The femoral CVC was kept for the administration of medications. Unfortunately, the patient died after 2 weeks of type 2 myocardial infarction from nosocomial infection.

Discussion

The incidence of catheter-related complications is higher in left-sided IJV catheterization due to anatomical differences.[5] These include catheter malposition and thoracic duct injury. The ideal CVC tip position is in the lower third of the superior vena cava or near the cavoatrial junction.[6] The right IJV course is direct into the right innominate vein compared to the left IJV, which runs through a longer course before draining into the superior vena cava. The left-sided catheter has a higher chance of abutting the vessel wall and is more likely to cause vascular injury due to friction. Other risk factors are anatomical variations, patient positioning, and the angle formed between the CVC tip and vessel wall. Our centre has published a case of inadvertent puncture of the right vertebral artery during right IJV CVC insertion due to the vessel's anatomical variation.[7] The catheter was removed under contrast study guidance by an interventional radiologist.

A case of bilateral pleural effusion and pneumomediastinum resulting from left subclavian vein puncture during peripherally inserted CVC line placement has been reported.[8] The patient presented with hypoxaemic respiratory failure. Pulmonary CT angiogram was performed to look for pulmonary embolism, revealing the vascular injury. A sternotomy, CVC removal, and primary repair of the subclavian vein were performed.

In our case, iatrogenic pleural effusions and mediastinal haematoma were diagnosed early from CT imaging, hence the prompt chest drains insertions and referrals to the respiratory, vascular, and interventional radiology teams. The removal of the extravasated CVC was performed without immediate complications. Rapid onset of chylothorax indicates acute leak or injury to the thoracic duct, particularly the left subclavian trunk, which drains into the left subclavian vein and left innominate vein junction. This was further suggested by a large mediastinal

haematoma evidenced on CT scan, which could have occurred during the initial puncture or catheter placement using Seldinger's technique. Catheter migration, however, could not be ruled out. Lymphangiography and lymphoscintigraphy are useful in identifying major lymphatic leaks.[9] Yet, a few cases reported in this study revealed no significant contrast leak and the location of the leakage could not be pinpointed. Another possible explanation for chylothorax is accumulation of PN into the pleural cavities through the extravasated CVC tip.

The anatomical connection between the pleural and mediastinal cavities has not been clearly illustrated in the literature. CT scan showed the anterior mediastinal haematoma was likely in communicating with the pleural cavities through the malpositioned CVC. In case of inadvertent catheter cannulation-related mediastinal haematoma, the catheter should not be removed until the injury site is visualized under surgical exploration or angiographic monitoring and immediate intervention is available.

Ultrasound guidance may not prevent catheter malpopasition, vessel injury during guidewire insertion, and dilatation of the punctured vessel. A blunted costophrenic angle can detect pleural effusion. A chest X-ray showing evolving widened mediastinum should give a hint on iatrogenic vascular injury.

Conclusion

CVC insertion under ultrasound guidance reduces complications but does eliminate the risk. Iatrogenic thoracic duct injury and catheter malposition should be considered, particularly when a left-sided neck vein is catheterized. PN administration through a misplaced catheter may be associated with chylothorax. A mediastinal haematoma could have occurred during the initial vessel puncture or catheter placement. This case highlights the significance of a high index of suspicion and timely multidisciplinary intervention in cases of rare and catastrophic complications to reduce adverse outcomes. Despite following the recommended precautions, the clinician must confirm catheter position post-insertion and continuously monitor its function. In our case, rapid chest drain insertion was followed by removal of the left IJV catheter.

Declarations

Informed consent for publication

The patient provided informed consent for to the publication of the clinical data and images contained in this case report.

Competing interests
None to declare.

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