



## Lower extremity peripherally inserted central catheter placement ectopic to the ascending lumbar vein: A case report

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### Abstract

#### BACKGROUND

Peripherally inserted central catheters (PICCs) are an essential infusion route for oncology patients receiving intravenous treatments, but lower extremity venipuncture is the preferred technique for patients with superior vena cava syndrome (SVCS). We report the case of a patient with a lower extremity PICC ectopic to the ascending lumbar vein, to indicate and verify PICC catheterisation in the lower extremity is safe and feasible. And hope to provide different perspectives for clinical PICC venipuncture to get the attention of peers.

#### CASE SUMMARY

On 24 August 2022, a 58-year-old male was admitted to our department due to an intermittent cough persisting for over a month, which worsened 10 d prior. Imaging and laboratory investigations suggested the patient with pulmonary malignancy and SVCS. Chemotherapy was not an absolute contraindication in this patient. Lower extremity venipuncture is the preferred technique because administering upper extremity venous transfusion to patients with SVCS can exacerbate oedema in the head, neck, and upper extremities. The patient and his family were informed about the procedure, and informed consent was obtained. After successful puncture and prompt treatment, the patient was discharged, experiencing some relief from symptoms.

#### CONCLUSION

Inferior vena cava catheterisation is rare and important for cancer patients with SVCS, particularly in complex situations involving ectopic placement.

**Key Words:** Superior vena cava syndrome; Peripherally inserted central catheter; Ascending lumbar vein; Complications; Case report

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**Core Tip:** The conventional peripherally inserted central catheter catheterization selected deep venous vessels in the upper limb. Patients with superior vena cava syndrome (SVCS), lower extremity venipuncture is the preferred technique because administering upper extremity venous transfusion to patients with SVCS can exacerbate oedema in the head, neck, and upper extremities. The greater angle of the left lower extremity vein through the common iliac vein into the inferior vena cava and the conundrum that the left side of the femoral vein does not easily enter the inferior vena cava when passing through the common iliac vein, a right lower extremity catheterisation was performed in this case report.

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## INTRODUCTION

Due to their safety, reliability, and applicability, peripherally inserted central catheters (PICCs) play a crucial role in delivering chemotherapy and other intravenous treatments to oncology patients. PICCs have effectively prevented issues like repeated punctures, venous injury from chemotherapy drugs, and tissue necrosis caused by drug extravasation. In oncology, the prevalence of superior vena cava syndrome (SVCS) is notable. SVCS occurs due to partial or complete blockage of blood flow back to the right atrium *via* the superior vena cava. Patients with SVCS present with acute or subacute dyspnoea and oedema of the face and neck. Lower extremity venipuncture is the preferred technique because administering upper extremity venous transfusion to patients with SVCS can exacerbate oedema in the head, neck, and upper extremities. Peripherally inserted central catheterisation in the lower extremity is safe and feasible, providing a viable path for establishing safe venous transfusion in patients with SVCS while reducing the discomfort associated with repeated venous punctures. However, despite its benefits, peripherally inserted central catheterisation is associated with several complications such as catheter dislocation, rupture, leakage, occlusion, infections, phlebitis, and venous thrombosis. Herein, the case of a patient with a lower extremity PICC ectopic to the ascending lumbar vein is reported.

## CASE PRESENTATION

### Chief complaints

An intermittent cough persisting for over a month, which worsened 10 d prior.

### History of present illness

In mid-July 2022, the patient developed intermittent cough, dry cough, but without diagnosis and treatment. In mid-August, the patient felt that his cough symptoms worsened, and was treated in a local hospital for chest computed tomography (CT) indicating lung occupying. Chest enhanced CT was further performed in The First Affiliated Hospital of Chongqing Medical University. Enhanced chest CT revealed a soft tissue mass in the right upper mediastinum and right hilus pulmonis suggesting a malignant neoplastic lesion, highly suggestive of mediastinal-type lung cancer involving the superior vena cava and the innominate vein, along with internal cancer thrombosis and multiple collateral circulations in the right neck and back root. Further, bronchofibrescopic biopsies were performed.

### History of past illness

The patient was previously healthy, with no history of chronic disease, infectious diseases, and also suffered no accidental trauma. He also has a history of smoking for about 30 years and drinking alcohol for more than 20 years.

### Personal and family history

Father died of natural causes, mother died of "lung cancer" and siblings are in good health.

### Physical examination

Temperature: 36.0 °C, pulse frequency: 76 times/min, respiratory rate: 20 times/min, blood pressure: 96/70 mmHg, clear mind, mental stability, walked into the ward, skin and mucous membranes of the whole body normal, no edema, no subcutaneous bleeding.

### Laboratory examinations

Except for the abnormalities of the relevant tumor markers, blood routine examination, urine routine examination, stool routine examination without special tips.

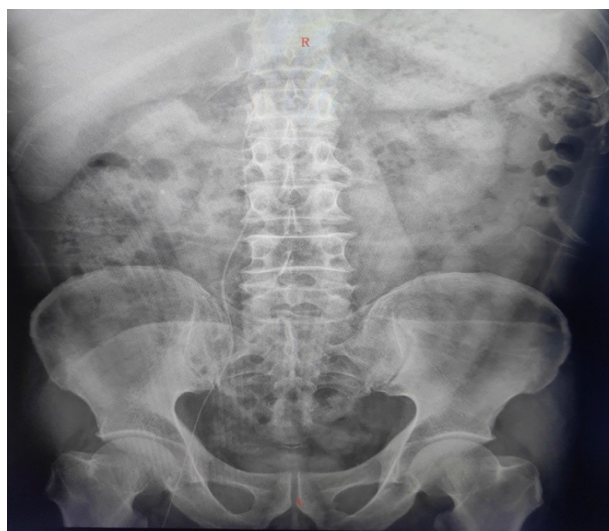


Figure 1 Catheter tip at the lumbar 1 segment.

### Imaging examinations

Enhanced chest CT revealed a soft tissue mass in the right upper mediastinum and the right hilus pulmonis, suggesting a malignant neoplastic lesion, highly suggestive of mediastinal-type lung cancer involving the superior vena cava and the innominate vein. Internal cancer-related thrombosis and multiple collateral circulations in the right neck and back root were also observed. Further, bronchofibrescopic biopsies confirmed the diagnoses of small cell lung cancer (cT4N3Mx) in the right hilus pulmonis, secondary malignancy in the lymph nodes, and SVCS.

## FINAL DIAGNOSIS

The following diagnoses were established: (1) Small cell lung cancer (cT4N3Mx) in the right hilus pulmonis; (2) Secondary malignancy in the lymph nodes; and (3) SVCS.

## TREATMENT

Chemotherapy was not an absolute contraindication in this patient. Therefore, the initial treatment involved a chemotherapy cycle comprising etoposide and cisplatin (etoposide 0.15 g venous drip/venous drip D1-3 + cisplatin 60 mg VD D1, 50 mg VD D2). An antiemetic was administered during chemotherapy to maintain the water-electrolyte balance. Additionally, a central catheter was inserted to treat SVCS.

## OUTCOME AND FOLLOW-UP

After successful puncture, abdominal radiography confirmed the catheter's placement at lumbar 1 (Figure 1). Prompt treatment, the patient was discharged, experiencing some relief from symptoms. The patient was re-examined on 18 September 2022. Blood coagulation was observed within the catheter and extension tube, indicating a blockage due to haemagglutination (Figure 2). Despite negative pressure thrombolysis using urokinase during pumpback, no blood was observed; however, the transfusion flow remained unobstructed. A second test of conventional chest and abdominal radiography were performed to confirm the catheter's placement, which indicated that the catheter tip was situated at lumbar 4, with 3 cm of it remaining exposed (Figure 3). This caused the catheter to bend within the vessel. Attempts to alleviate the obstruction by connecting saline to the syringe and quickly injecting it from the catheter cavity were made, followed by a re-examination through chest and abdomen flat slice imaging. Despite these efforts, the catheter tip was still located at lumbar 4. Although the catheter was retained due to successful administration of the second-cycle treatment, a CT re-examination at the end of the third-cycle treatment displayed the absence of the catheter within the superior vena cava (Figure 4). This was suggestive of a potential ectopic position. Subsequent analysis of vascular anatomy and CT images by the radiologist confirmed the catheter's ectopic placement within the ascending lumbar vein (Figure 5). Reporting this to the hospital's venous specialist team prompted catheter removal, with successful blood retraction and transfusion upon catheter retraction to 28 cm. Finally, the catheter was safely secured after being cut and repositioned into the external iliac vein (Figure 6).



Figure 2 Coagulated blood in the catheter and extension tube.



Figure 3 The bent catheter tip at the lumbar 4 segment.

## DISCUSSION

### Assessment

It is crucial for the nursing team to thoroughly evaluate the vessel before surgery to prevent potential intravascular complications[1].



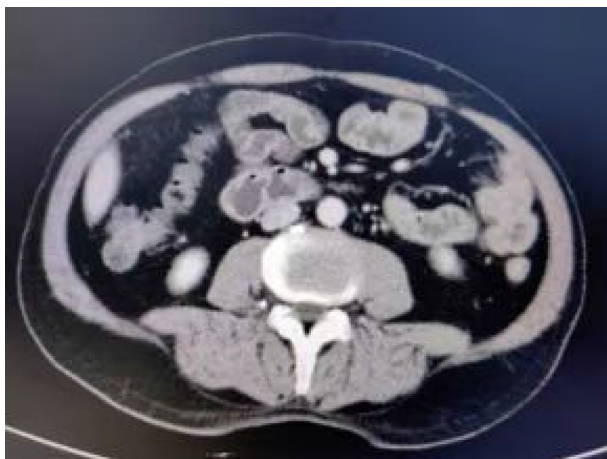


Figure 4 Computed tomography image revealing that the catheter was not in the superior vena cava.

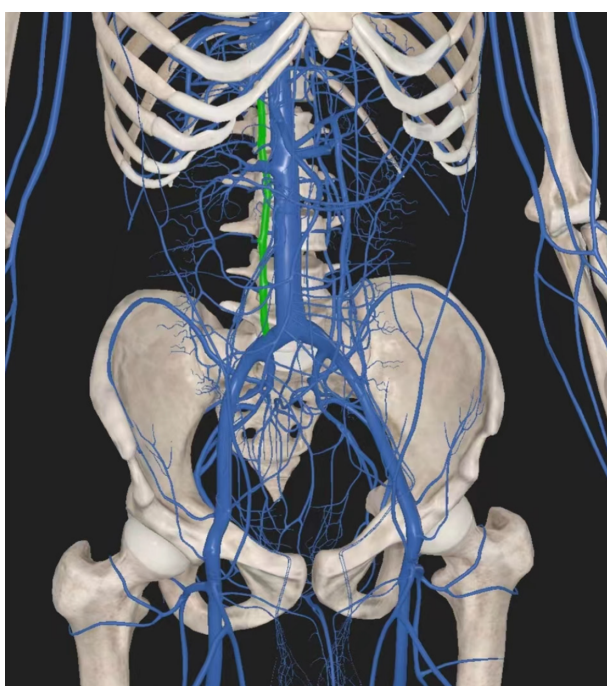


Figure 5 Three-dimensional body vascular anatomy.

### **Lower extremity vessel selection**

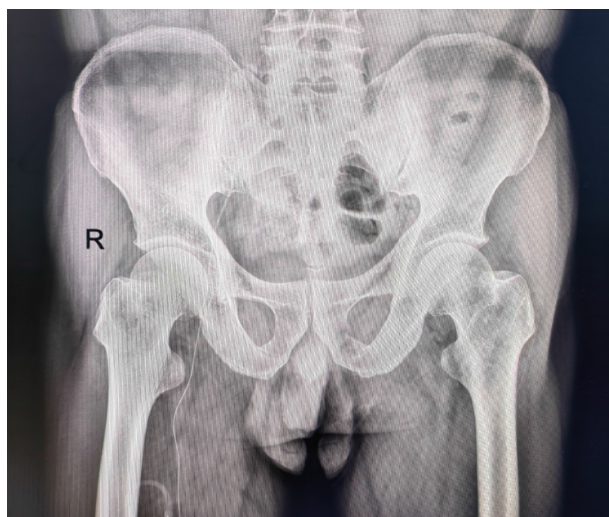
In clinical practice, the right lower extremity vein is preferred for lower extremity catheterisation[2,3]. The complexity arises from the greater angle of the left lower extremity vein and passage through the common iliac vein into the inferior vena cava on the left side, making it challenging to place a catheter in the left lower extremity vein.

### **Causes of catheter blood regurgitation**

Several factors, such as blockage of the catheter's open end, blood regurgitation due to various factors including cough-induced pressure[4], improper sealing of the catheter after transfusion, blood clot formation within the catheter, vascular injury, blood flow stagnation, a hypercoagulable state of the patient, and intraluminal occlusion due to fibrin or clot formation[5]. Considering these factors is crucial in clinical practice.

### **Identification of catheter ectopia**

The lumbar veins are the ventral branches of the inferior vena cava. The dilated ascending lumbar vein is easily accessed using a guidewire. However, due to its alignment with the inferior vena cava along the longitudinal axis, distinguishing it in resulting radiographs becomes challenging. Moreover, the infrequency of such cases adds to the difficulty in identification. After encountering a series of late complications, a conclusion was reached through multidisciplinary discussions and CT.



**Figure 6** Catheter tip in the external iliac vein.

### **Location of the catheter tip**

Relevant studies suggest that an inaccurate position of the catheter tip poses a risk for unplanned extubation[6]. Herein, the lower extremity PICC tip did not fully reach the inferior vena cava[7]. Therefore, it is essential to consider the nature of the drug before administering it. Additionally, to prevent associated complications, a thorough assessment of catheter function and drug properties by the sedation nurse specialist, clinician, and pharmacist is essential before administration.

## **CONCLUSION**

Incorrect catheter tip placement increases the risk of vascular perforation, infection, and ectopia, increasing the probability of arrhythmia, thrombosis, and potentially fatal outcomes[8]. This report highlights an unusual instance of a lower extremity PICC positioned ectopically in the ascending lumbar vein. Our study provides a basis for subsequent clinical care. It emphasises the need to holistically assess the patient's overall condition by considering various factors in the context of the primary issue. Accurately identifying the vascular anatomy and precise determination of the catheter tip's location are crucial for effective treatment and medication administration, particularly in patients with cancer. Early identification can lower complication rates, prolong catheter retention time, and improve patient satisfaction and quality of life. The collaborative efforts of a multidisciplinary team are crucial role in successful peripherally inserted central catheterisation and relevant care. However, inferior vena cava catheterisation is rare, particularly in complex situations involving ectopic placement. Therefore, multidisciplinary team collaboration, standardisation, and evaluation for special patient punctures have gained the interest of researchers.

## **FOOTNOTES**

**Co-first authors:** Xiao-Ju Zhu and Ling Zhao.

**Author contributions:** Zhu XJ was the patient's supervisor nurse, who carried out the study, reviewed the literature, contributed to manuscript drafting, and was responsible for revising the manuscript for important intellectual content; Zhao L, Peng N, Luo JM and Liu SX reviewed the literature and contributed to manuscript drafting; Zhu XJ and Zhao L contributed equally to this work as co-first authors; All authors issued final approval for the version to be submitted.

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