

## Rare malposition of a central venous catheter into the left internal mammary vein in a liver transplantation patient

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**Abstract** We report a rare malposition of a central venous catheter in a liver transplantation patient which occurred during an intensive care period. The waveform of central venous pressure was aberrant after connecting the catheter to the pressure kit transducer. It was misplaced into left internal mammary vein confirmed by thoracic computed tomography. Significant engorgement of the left internal mammary vein may have been the cause of this rare malposition.

**Keywords** Central venous catheter · Malposition · Liver transplantation · Portal hypertension · Internal mammary vein

A central venous catheter (CVC) enables measurement of hemodynamic variations, and delivery of medications and nutritional support. Various complications of central venous catheterization have been reported, including malposition, arterial puncture, hematoma, pneumothorax, hemothorax, infection, and thrombosis. We report placement of a CVC via the left internal jugular vein (IJV) in a patient after a liver transplantation. Malposition of the

CVC into the left internal mammary vein (IMV) was subsequently diagnosed. The main cause of this rare malposition and methods of prevention are discussed below.

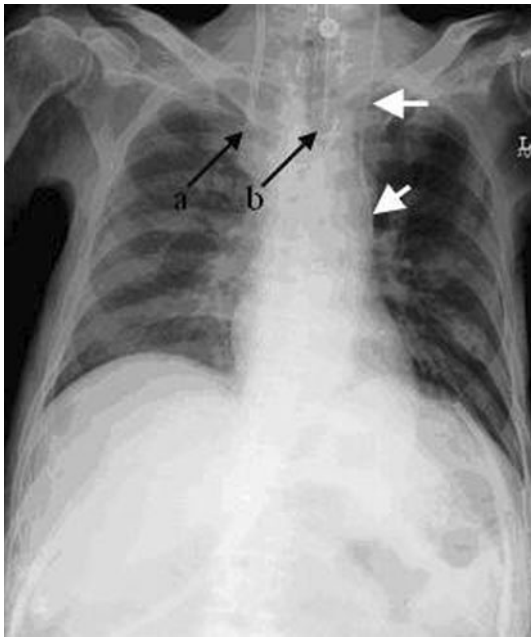
A 54-year-old man was admitted to a surgical intensive-care unit after a liver transplantation for end-stage liver cirrhosis. After local anesthesia the left IJV was punctured and dark venous blood was obvious. No difficulties were encountered inserting the J-tip guide wire and the dilator. An 8 Fr. three-lumen CVC was subsequently railroaded and advanced 20 cm without encountering any resistance and venous blood aspirated through the three lumens of the catheter without any signs of obstruction. The patient experienced no hemodynamic changes through the procedure. The waveform of central venous pressure (CVP) was aberrant after connecting the catheter to a pressure kit transducer. Instead of typical a, c, v waves and x, y descents, a flattened CVP waveform was apparent. A roentgenogram was immediately arranged to confirm the catheter position (Fig. 1). The catheter descended lateral to the left mediastinal margin without signs of either a pneumothorax or pleural effusion. A thoracic computed tomography (CT) scan was then performed to better define the exact anatomic location of the CVC (Fig. 2). CT revealed that the CVC was inserted into the left IMV.

A CVC is useful for critical patients in the intensive-care unit for hemodynamic monitoring, fluid resuscitation, intravenous drug infusion, and hyperalimentation. Malposition of the CVC is only rarely reported, with incidence of 1–6% [1]. Despite its rarity, CVC malpositioning can lead to disastrous results. Congenital anomalies in the patient's anatomy, postoperative anatomic changes or disease-induced structural alterations can each increase the incidence of CVC malpositioning. The left IMV is one of the tributaries of the left innominate vein. Generally, the left IMV is a small tributary and is not easily tunneled by a

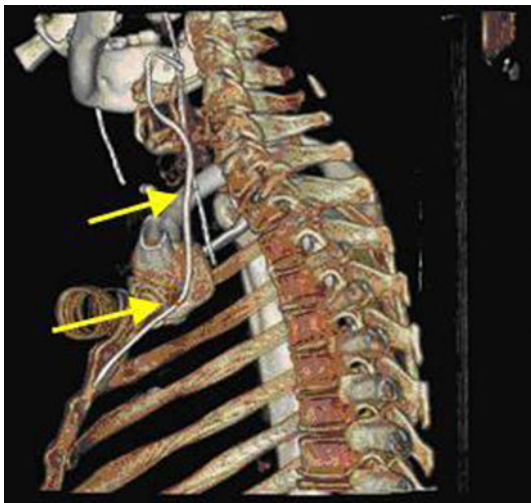
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**Fig. 1** Chest roentgenogram shows the 8 Fr. CVC (white arrows) descending lateral to the left mediastinal margin. The black arrows indicate the 9 Fr. trauma catheter (a) and tracheal tube (b)



**Fig. 2** The thoracic CT scan with 3D reconstruction shows the catheter (arrows) behind the sternum in the left internal mammary vein

J-tip guide wire despite the fact that the IMV's opening is almost opposite to the orifice of the IJV. The IMV plays an important role in collateral circulation during portal hypertension and is thought to be more engorged in portohypertensive patients [2]. The patient described herein had long-term liver cirrhosis (Child–Pugh class C). During liver transplantation, significant engorgement of the venous system was noted by the surgeon. Furthermore, the thoracic CT after CVC catheterization showed that the patient's

right IMV was 5.33 mm in diameter which was almost twice dilated than normal. Although the left IMV was cannulated by the CVC and it was hard to measure the exact diameter, portal hypertension-induced collateral vessels were almost symmetrical. This evidence convinced us that the guide wire could descend straight into the left IMV without resistance and make CVC tunneling easier. Although this unexpected catheterization of the left IMV has been reported in the literature, this seems to be the first report of malposition of the CVC into a presumably dilated left IMV after liver transplantation [3].

Webb et al. [4] reported localized pain after such malposition and Kanter and Connelly [5] described retrosternal chest pain radiating to the back as the most common symptom of malposition. The report by Sandroni et al. [3], however, stated that their patient had no specific symptoms with left IMV tunneling. Subjective discomfort was not obvious as has been reported by others because the patient presented in this report was intubated during catheterization. In the case described here, the error in tunneling was not detected until an aberrant CVP waveform was noted. Sandroni et al. [3] stated their patient had the CVP value of 7 cmH<sub>2</sub>O without mention of the waveform. For detecting locations of CVC, the CVP waveform is more important than the value because actual central venous tracing indicates the appropriate location of the CVC tip.

This case highlights the importance of CVP waveform monitoring and chest roentgenogram to ensure proper catheter placement, especially in unconscious or intubated patients in the intensive-care unit. Fluoroscopic examination and CT scanning are also useful tools in cases of CVC malpositioning for identification of the cannulated vein [3].

A 9 Fr. trauma catheter (Multi-Med Central Venous Catheter, triple lumen; Edwards Lifesciences) was in the right IJV in this patient; it had been cannulated after general anesthesia for massive transfusion during the operation. This is why the left IJV was selected for insertion of the CVC before removing the 9 Fr. trauma catheter. Whenever possible, CVC should be placed via the right central vein because the left IJV has more tributaries than the right when it converges into the left innominate vein [2]. If catheterization on the left side is necessary, approaching from the left subclavian vein can attenuate the risk of small tributary tunneling. In addition, limiting the depth of insertion of the guide wire during left IJV cannulation will also reduce the chances of IMV tunneling [2].

In summary, chances of CVC malpositioning to the left tributaries via left IJV catheterization are increased in patients with portal hypertension. Right IJV cannulation reduces the incidence of malpositioning, which can be symptomatic or asymptomatic. CVC waveform monitoring and radiological verification of accurate CVC positioning are essential.

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