

CASE REPORT

Central venous catheter malposition mimicking an arterial waveform

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Abstract

Although central venous catheterisation is a routine procedure for the management of critically ill patients, malposition of the catheter tip can cause multiple severe complications. Malposition cannot always be prevented by ultrasound-guided introduction, and clinical recognition remains important. We describe a patient with a very rare central venous catheter malposition. Pressure monitoring played a contributing role in the recognition of malposition by suggesting an arterial waveform.

Introduction

Central venous catheterisation is an invasive procedure to assess a patient's volume status, cardiac function and vasomotor tone [1]. Although a routine procedure, placement of a central venous catheter (CVC) has multiple complications including malposition of the catheter tip. Malposition cannot always be prevented by ultrasound-guided introduction, and clinical recognition remains important. We describe a patient with malposition of a central venous catheter mimicking an arterial waveform.

Case history

A 45-year-old man with a subarachnoid haemorrhage complicated by intraventricular bleeding was admitted to our intensive care unit. In order to maintain an optimal cranial perfusion pressure a CVC was introduced in the left internal jugular vein (IJV) under in-plane ultrasound guidance by an experienced operator. Cannulation was uneventful and after blood aspiration the CVC was fixated at 20 cm. To exclude malposition or other complications a routine chest X-ray was performed.

The chest X-ray showed an abnormal position of the CVC tip (figure 1: blue arrow). The radiologist suggested an arterial position, although a repeated ultrasound investigation

confirmed a venous insertion. In order to discriminate between the two, we connected a pressure monitoring system. We measured a pressure of 15/7 mmHg and although the pressure waveform was highly abnormal, it suggested an arterial position of the catheter tip (figure 2: yellow line [PAP]). The timing of the peak wave was not compatible with a high v-wave and cardiac ultrasound showed a normal heart without tricuspid regurgitation. An additional CVC was introduced in the contralateral IJV (figure 1: green arrow) showing a normal central venous pressure waveform including normal a,c and v-waves (figure 2: blue line [CVD]).

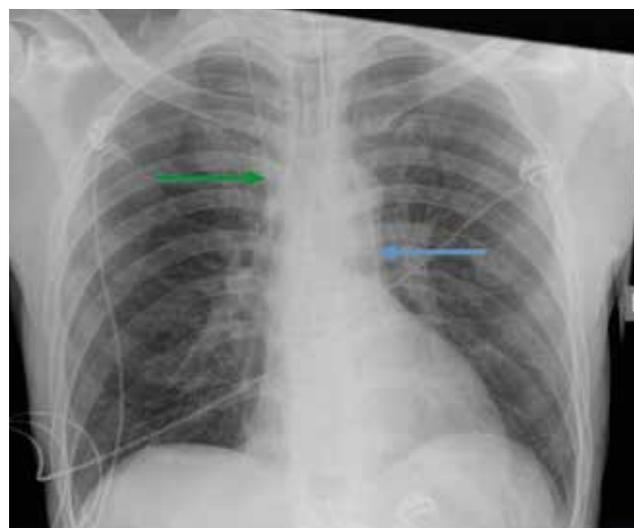


Figure 1. AP chest X-ray: two CVCs are visible, the blue arrow indicates the first CVC with malposition left parasternally over the heart, the green arrow indicates the second CVC with its tip projecting over the superior vena cava.



Figure 2. Monitor screenshot: from top to bottom, heart rate (HF), invasive arterial blood pressure (ABP), central venous pressure (CVP) (right CVC), 'pulmonary artery pressure' (PAP) (left CVC).

Contrast angiography via the left CVC showed a venous structure. Moreover, blood samples taken from both the left and right CVC revealed comparable central venous saturation (ScvO₂) results (68 and 70, respectively). We concluded that the catheter was accidentally positioned in the left internal thoracic vein or the pericardiophrenic vein (*figure 3*). The 'arterial' waveforms can be explained by pressure and pulse waves of the contraction and filling of the heart transmitted to the CVC. The left CVC was removed and the patient suffered no adverse events from the accidental malposition.

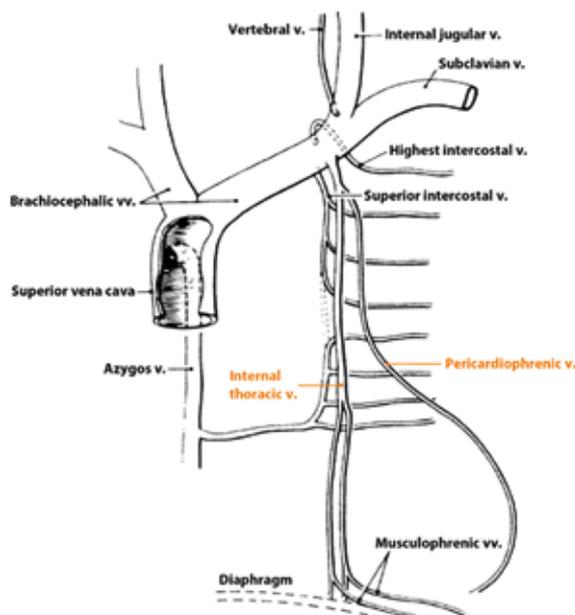


Figure 3. Anatomy of the venous system: the internal thoracic vein and the pericardiophrenic vein.

Discussion

CVC placement is a routine procedure for the management of critically ill patients. Proper positioning is essential for adequate measurement of central venous pressure and safe infusion of 'irritating' intravenous drugs. Also the risk of central venous thrombosis increases with improper positioning^[1,2]. The IJV is the most frequently used vein for this purpose. Ultrasonography is used to locate the IJV and reduce the complications of catheterisation^[1,3,4]. The appropriate location of the tip of the CVC for measuring central venous pressure is the junction of the superior vena cava to the right atrium. The incidence of malposition has been reported to be 3 to 4%. The most common reports of malposition refer to subclavian vein cannulation^[5]. In our case a very rare malposition is reported, located in either the left internal thoracic vein or the pericardiophrenic vein and very close to the heart, therefore mimicking arterial pressure waveforms. Only a few case reports describe an accidental positioning in these veins^[6-9], though none mentioned the use of a pressure monitoring system and the discovery of 'arterial' waveforms.

In this case pressure monitoring played a contributing role in the recognition of malposition and consequently the prevention of CVC-related complications. It can provide fast and bedside information even before routine chest X-ray. Registered waveforms should be interpreted in the context of other clinical characteristics. Angiography and ScvO₂ sampling confirmed a definite venous position of the CVC.

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