Central Venous Catheters: A Closer Look at the Subclavian Vein Approach

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INTRODUCTION

Central venous catheters (CVCs) are commonly used and have a range of outpatient and inpatient indications. A subclavian vein approach has traditionally been used for placement of these catheters; however, this method exposes the patient to the high risk of subclavian stenosis as well as an increased risk for catheter fracture. In this report, we describe a patient with a chemotherapy port placed in the subclavian vein that underwent spontaneous fracture. We therefore advocate for the use of an internal jugular approach for CVCs.

CASE REPORT

A 62-year-old man with a history of Kaposi’s sarcoma was referred to interventional radiology for a percutaneous chemotherapy port study. The percutaneous port was originally placed through the left subclavian vein for adjuvant chemotherapy. Port malfunction was first noticed during a routine follow-up appointment with the patient’s hematology oncologist. Blood return was sluggish and there was a noticeable soft lump at the upper sternum after flushing. A Port study was performed under fluoroscopic guidance. The initial AP view of the chest (Figure 1) revealed luminal narrowing and “pinch off” sign at the intersection of the clavicle and first rib. Digital subtraction acquisition with contrast confirmed the location of the fracture (Figure 2). Contrast extravasation was documented at the location of the soft swelling (Figure 3). The device was removed in the interventional radiology suite. Gentle traction was used to remove the catheter, given the known damage and possible risk for embolization of the catheter tip. Upon removal, parallel 1cm long longitudinal fractures were identified at the fluoroscopically identified point of extravasation (Figure 4).

Figure 1. AP chest under fluoroscopy showing a chemotherapy port placed in the subclavian vein illustrating the “pinch off” sign. Fracture occurred at the location of the clavicle and first rib.

Figure 2. Digital subtraction angiography showing extravasation of contrast revealing the catheter fracture.
DISCUSSION
Various factors leading to catheter fracture have been recognized. It has been well established that catheters placed in the subclavian vein are exposed to high mechanical friction from the clavicle and first rib. Compressive forces can cause transient obstruction. Over time, repetitive stress on the catheter causes structural degradation leading to fracture. Previously reported incidences for catheter fracture have ranged from .1–1.3%. Occult fracture may first be noticed with difficulty administering or aspirating fluid through the line. More serious symptoms may present as extravascular administration of medications through the fractured line or embolization of the catheter tip.

Early diagnosis of catheter fracture is key to management. Chest x-ray can provide the earliest radiographic evidence for possible catheter fracture with a positive “pinch off” sign. Patients with a positive “pinch off” sign have an estimated 40% risk for catheter fracture and such catheters should be removed and replaced using another vessel. If fracture is suspected and complete transection has occurred, the patient should undergo emergent percutaneous retrieval by interventional radiology, which has been shown to be a highly successful and safe procedure.

Catheter fractures are a rare event. Stenosis is a more common and insidious complication of subclavian venous catheter placement. Venous stenosis in the setting of subclavian catheters has a reported incidence of 32–50%, typically seen with catheters used for greater than 2 weeks of duration. The mechanism for stenosis is catheter-induced thrombosis and intimal fibrosis due to the presence of a foreign object in a narrow vessel lumen at the restricted anatomic space between the first rib and clavicle. Utilization of larger caliber vessels such as the internal jugular vein for catheter placement has been shown to minimize this complication, with reported stenosis rates as low as 3%.

Though the subclavian vein has been the preferred site for many proceduralists, given the evidence of complications with long-term use, many have advocated for the internal jugular vein as the first-line approach. It is well documented that an internal jugular approach with image guidance provides a safe and reliable method for long-term central venous catheters. The course of the internal jugular vein is free of anatomic features that may cause compression or catheter damage. It has a large caliber and high flow to reduce the risk for thrombosis. Other risks such as infection are comparable to the subclavian approach, while pneumothorax risk is diminished. Finally, complications such as brachial plexus injuries and thoracic duct injuries are unique to a subclavian catheter and are also avoided.

CONCLUSION
Central venous catheter placement through the subclavian vein has a high rate of vein stenosis and increased risk for catheter fracture. Catheter fracture is less common, but may lead to dangerous complications such as extravascular extravasation of medication or embolization. Subclavian stenosis can severely limit venous access which becomes problematic for patients requiring long-term parenteral therapy. The Internal Jugular approach with imaging guidance minimizes risk and provides a proven, safe and reliable alternative.
References


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