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Pinch-off syndrome. Case report and review of the literature

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Abstract

Central venous catheterization is a common procedure in the emergency and intensive-care units. Rupture of the central catheter has been described as a rare complication in patients with permanent subclavian catheters. We report the case of a patient with rupture and central catheter and embolization secondary to intermittent mechanical compression by the subclavian and the first rib (pinch-off syndrome) and its resolution through a percutaneous device. (Gac Med Mex. 2015;151:494-6)
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Introduction

Central venous catheterization is a very common procedure in medical emergency areas and intensive care units. Insertion of a catheter into the intravascular space can be accomplished by direct puncture with ecographic vision-guided Seldinger technique, or by peripheral venous puncture.

Indications are varied, including administration of hyperosmolar and hypertonic solutions, chemoterapy, antibiotics and vasoactive drugs. It is also used for diagnostic testing or therapeutic procedures, such as pulmonary artery catheter (Swan-Ganz catheter) insertion. Specific indications are invasive hemodynamic monitoring, central venous pressure monitoring, pulmonary artery pressures and pulmonary artery occlusion pressure surveillance; diagnostic studies such as cardiac catheterization, arteriography, angioplasty, biopsies and management of therapeutic procedures by interventional radiology such as selective embolizations, biopsies and porto-systemic shunt placement at the hepatic level.

Subclavian venous access has less probability of catheter-related infection than internal and femoral jugular access[1,2]; however, the subclavian route has beeen associated with important mechanical complications such as arterial puncture (3.1-4.9%), hematoma (1.2-2.1%), pneumothorax (1.5-3.1%) and hemothorax (0.4-0.6%)[1].

Case description

This is the case of a 61-year-old female with a previous history of dyslipidemia, osteoarthrosis, recent diagnosis of breast cancer (Her-2-Neu-positive ductal adenocarcinoma) 3 months prior to her admission, who had a venous access catheter port implanted for chemotherapy administration with no complications. At subsequent visits for chemotherapy administration, she had catheter dysfunction that was corrected with right arm elevation. At her last visit, more catheter dysfunction with no correction by position was substantiated, which prompted to have a chest x-ray performed that documented a fracture and embolization of the distal extreme of the catheter at the level of the pulmonary

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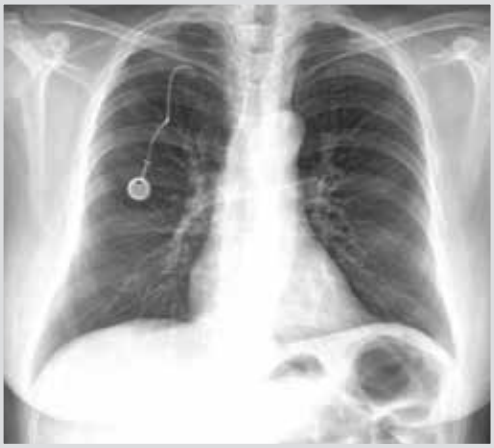

Figure 1. *Posteroanterior chest x-ray where the catheter occupying the right and left pulmonary branches and the pulmonary trunk is observed.*

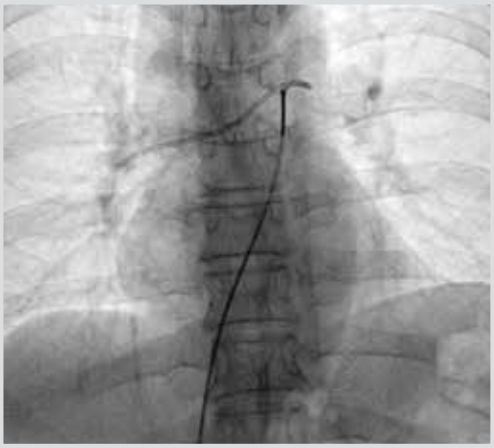

Figure 2. *Fluoroscopic image of catheter fragment fixation with the loop catheter.*

artery bifurcation (Fig. 1), a finding consistent with pinch-off syndrome; thus, the patient was referred to the Instituto Nacional de Cardiología for the catheter to be extracted by peripheral intervention. On evaluation at the emergency unit, the patient was asymptomatic, hemodynamically stable, with normal cardiovascular exploration. She was taken to the hemodynamics room and, by using a loop catheter, fixation (Fig. 2) and extraction of the migrated catheter through a femoral access was accomplished (Fig. 3) without any complication. The patient was discharged 12 hours later to continue with chemoterapy and to plan a new catheter port insertion.

Review

Central catheter rupture has been described as a rare complication in patients with indwelling subclavian catheters[3,4]. Distal portion of the catheter can embolize the heart and cause complications such as arrhytmias, endocarditis, heart perforation and pulmonary embolism.

Transection of a central catheter can be caused by defects of the catheter, trauma of the catheter at the moment of insertion or by damage produced by the needle when a second catheter is inserted in the same place.

Central venous catheter transection can also de due to compression at the site of catheter insertion in the costoclavicular area (cervicoaxillary canal)[5,6]. This area is limited anteriorly by the clavicle, the subclavian muscle and the costocoracoid ligament; the posterior margin is limited by the first rib and the scalene ligament.

A bad positioning of the catheter across this space from outside of the subclavian vein before medially reaching the vessel can result in catheter compression. A more lateral insertion of the catheter in the subclavian vein, where the angle between the clavicle and the first rib is wider, minimizes catheter compression.

Intermittent catheter compression is referred to as pinch-off syndrome[5,7,8]. This pinch-off syndrome can be identified in the chest x-ray when narrowning of the catheter lumen along its passage between the clavicle and the first rib is observed. Hinke, et al.[6] developed a scale based on radiographically observed catheter distortion:

- Grade 0, the catheter follows a trajectory across the region of the clavicle and the first rib with no narrowing.

Figure 3. *Extraction of the catheter fragment with a loop catheter through the femoral venous access.*

- Grade 1, the catheter shows some degree of flexion or deviation but without luminal narrowing.
- Grade 2, the catheter shows certain degree of narrowing of the lumen when it passes below the clavicle (real pinch-off sign).
- Grade 3, the catheter is sectioned between the first rib and the clavicle with embolization of its distal portion[5].

Most common sites of catheter fragments embolization are the pulmonary artery (35%), right atrium (27.6%), right ventricle (22%) and superior vena cava or peripheral veins (15.4%)[9].

The first catheter compression and transection-associated symptoms are intermittent resistance to the passage of solutions, variable hemodynamical status in patients on inotropes due to variable passage of medications, edema in the anterior region of the chest near the site of insertion, frequent ventricular extrasystole in case of embolization of intracardiac catheter[7,8]; complications include arrhythmias, endocarditis, right ventricle perforation and pulmonary embolism.

In a series published by Serov, et al.[9] (215 cases), catheter fracture and embolization clinical signs included catheter malfunction (56.3%), arrhythmias (13%), pulmonary symptoms (4.7%) and sepsis (1.8%), but 24.2% of cases were asymptomatic.

Mortality associated with distal catheter fracture and embolization was reported in between 28 and 57% of the cases (between 1950 and 1980), where catheter materials were different; in the series by Serov, et al., mortality of 1.8% was reported[9].

The occurrence of pinch-off syndrome can be very early (months) or late (years). In a series of cases described by Mirza, et al.[10], of all 112 reported cases, average time for the syndrome to occur was 5.3 months, with a range as high as 60 months.

The use of ultrasound to guide the placement of central venous accesses has been shown to be an efficacious tool with a lower rate of complications compared with the landmark method[11].

Most catheter fragments are extracted using precutaneous intervention techniques through the femoral vein. This approach was described since 1962 and represents the gold standard technique for the removal of foreign bodies in the venous system[12]. A small proportion of cases (4.2%) cannot be removed by intervention because fragments adhere to the vessel wall and, therefore, surgery is required[9].

Loop catheter can be used both in interventional cardiology and neurology, as wel as in radiology. Its double plane design allows the capture and retrieval of objects more safely and quickly, in addition to the size of the loop being variable in order to perfectly adapt it to the size of the object to be retrieved. It has a platinum thread lining for an excellent radio-opacity and resistance to traction, which also allows for greater torque, thus enabling the loop to freely spin in order to enhance positioning.

There are other systems involving multiple loops such as the EN Snare® endovascular loop system (Endovascular Snare System; Merit Medical Systems), designed with three intertwined loops (nitinol, which confers resistance to folding and torque control) to extract and manipulate foreign objects in the body, with a variety in sizes ranging from 2 mm up to 45 mm.

Conclusions

The pinch off syndrome, which can result in transection and embolization of subclavian catheter, is a rare alteration not suspected by the clinician as causative of dysfunction and that can be life-threatening for the patient. The use of ultrasound to guide punctures is an efficacious tool that reduces the rate of mechanical complications. Percutaneous intervention with femoral approach using a single or multiple loop catheters is considered the gold standard technique for the retrieval of foreign bodies in the venous system.

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