Knotting of Central Venous Catheters: Nonsurgical Correction*

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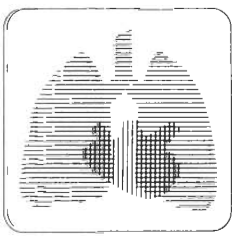

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Knotting of Central Venous Catheters: Nonsurgical Correction*

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A complete knot occurred in a central venous catheter inserted through the subclavian vein. By passing a spring guidewire into the catheter under fluoroscopic control, the knot was easily untied leaving the catheter correctly in place.

The benefit obtained from placing a central venous catheter is well documented, but must be weighed against the complications of this procedure. The most frequently recorded are introduction of infection, thrombophlebitis, and perforation of the cannulated vessel producing a local hematoma, pneumothorax or hemothorax. Fewer reports concern the occurrence of looping of the catheter lying in a large central vein,[1] while the occurrence of a knot is quite unusual. One report[2] described the finding, after withdrawal of the catheter, of a simple tight knot 1 cm from the catheter tip.

The case report presented here describes a simple technique for overcoming the problem of knotting of a central venous catheter.

Case Report

A 51-year-old obese woman was admitted to the Intensive Care Unit with a diagnosis of acute on chronic respiratory failure. As part of her management, a Swan-Ganz balloon-flotation catheter was introduced into the pulmonary artery via the right subclavian vein. After four days, the Swan-Ganz catheter was removed and a 16-gauge 12-in Teflon catheter was introduced into the subclavian vein. A subsequent chest x-ray film (Fig 1) showed that the tip of the catheter had described a complete loop of 360° and had then passed through this loop, forming what appeared to be a simple knot lying at the level of the fifth to seventh thoracic vertebrae. The length of the loop was approximately 5 cm. The catheter was withdrawn this distance and a further chest x-ray film confirmed that this was indeed a knot which had then been decreased in size and had risen to the level of the fourth and fifth thoracic vertebrae (Fig 2). Under fluoroscopy and using a sterile technique, the catheter was advanced further into the superior vena cava again increasing the size of the knot. The stiffer end of a 0.9 mm Teflon-coated spring guidewire (USCI) was introduced into the catheter and carefully advanced under fluoroscopy to the level of the knot. By gently advancing the guidewire further it was possible to untie the knot and leave the catheter properly placed in the superior vena cava (Fig 3).

Discussion

The occurrence of catheter knotting during cardiac catheterization is well documented and was first reported in 1954.[3] Other reports have described knots occurring in flow-directed balloon catheters,[4,5] angiography catheters,[6] semifloating pacing wires,[7] and catheters used to record His bundle electrograms.[8] The formation of a simple knot in a central venous catheter introduced through the subclavian vein has been reported only once.[2] This knot, which was noticed only after

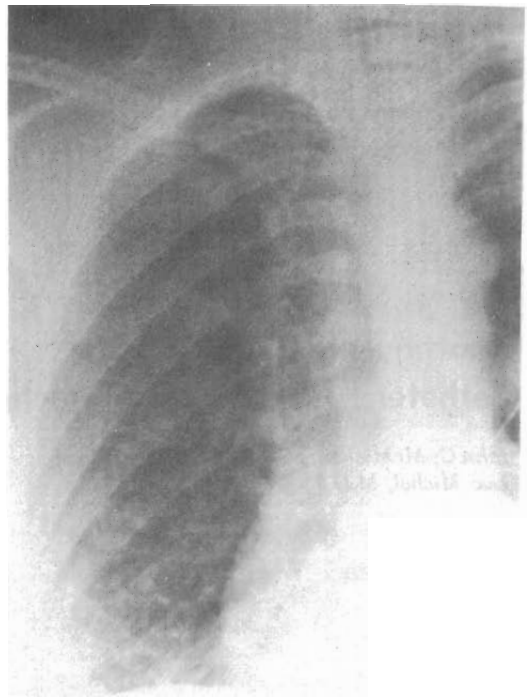

FIGURE 1. Chest x-ray film showing complete knotting of central venous catheter lying in superior vena cava.

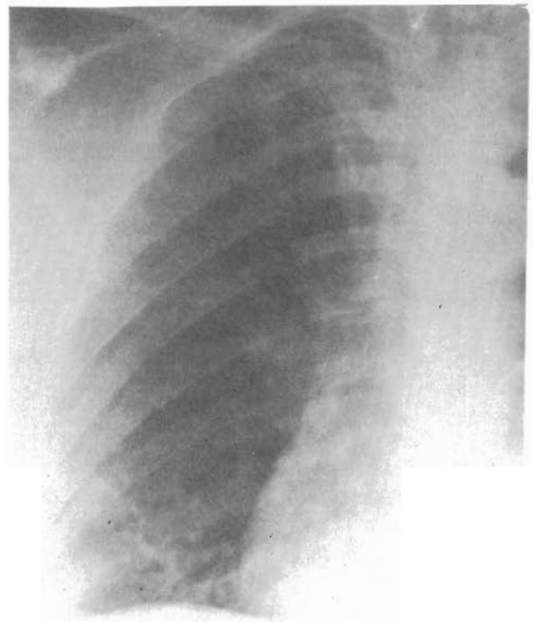

FIGURE 2. Chest x-ray film of same patient as Figure 1 showing that withdrawal of catheter has elevated and tightened knot.

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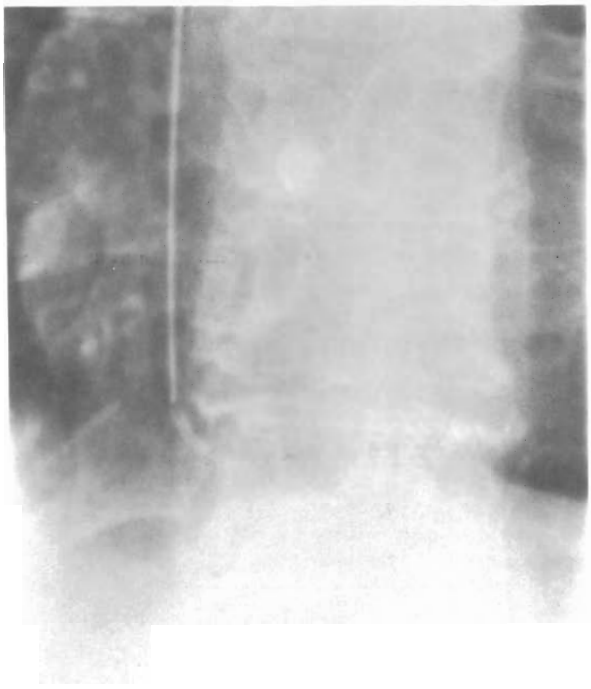

FIGURE 3. Guidewire is shown within catheter after knot has been untied.

removal of the catheter, was also found on retrospective review of the chest radiograph. It has been shown that loops and kinks in central vein catheters are associated with thrombus formation.[9,10] The early detection of such abnormalities is therefore important and emphasizes the need for immediate radiological assessment of catheter placement.

If a loop is seen on a chest radiograph, withdrawal of the catheter for a distance equivalent to the length of the loop will correct the problem if knotting has not occurred. However, it is not possible on a plain radiograph of the chest to distinguish between some loops and knots. Visualization of the catheter under fluoroscopy makes this distinction possible and allows for the safe manipulation of the guidewire within the catheter.

The guidewire technique has been used for a knot found in a 7F flow-directed balloon catheter.[5] Alternative methods for dealing with knots have been described. The disentanglement of a knotted pacemaker wire has been achieved by pulling and rotating it through the distal end of an introducer.[8] This is not recommended for use with hollow venous catheters as the catheter may be cut off by the tip of the introducer. The withdrawal of the knot through the venipuncture site has been used for cardiac catheters,[3,4] but is not recommended for catheters introduced through the subclavian vein as uncontrollable hemorrhage may result.

The careful use of a Teflon-coated spring guidewire under fluoroscopic control is a safe and successful method of untying knots occurring in central vein catheters. It will not succeed when the knot is tight. Therefore, when a knot is suspected on chest radiography, the catheter should not be withdrawn. The knot should be confirmed with fluoroscopy and manipulated by the guidewire technique.

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