J HK Coll Radiol 2002;5:69-72

HOW I DO IT

Percutaneous Insertion of Hickman Central Venous Catheter: Jugular Approach

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ABSTRACT

Traditionally, tunnelled central venous catheter insertions have been performed by surgeons. However, there is an increasing trend towards central catheters being placed by interventional radiologists under image guidance. The many advantages of inserting central catheters via the jugular approach under image guidance include reusable venous access, generally less waiting time compared with surgical placement, short fluoroscopy and procedural time, high success rate, paucity of major complications, no need for general anaesthesia, and the procedure being well tolerated by most patients.

The subclavian vein provides alternative venous access, although insertion of catheters via this approach may lead to intimal hyperplasia, venous stenosis, venous thrombosis, or subsequent fracture of the catheter. Percutaneous insertion of Hickman central catheters via the jugular approach is therefore the preferred method. It offers a safe and effective alternative to surgical placement and the subclavian approach.

Key Words: *Central venous catheterisation, Jugular veins*

INTRODUCTION

Percutaneous insertion of a Hickman central catheter via the jugular approach offers a sound alternative to the traditional subclavian surgical approach. The entire procedure is performed under imaging guidance, which ensures both the safety and effectiveness of this method of providing venous access.

INDICATIONS AND CONTRAINDICATIONS

Temporary or permanent central venous access is frequently necessary in patients undergoing haemodialysis, chemotherapy, bone marrow transplantation, long-term antibiotic therapy, and parenteral nutrition. In our institution, the majority of patients referred for Hickman catheter insertion are from the Haematology Division of the Department of Medicine, the Department of Orthopaedics and Traumatology, and the Department of Clinical Oncology, and are suffering from blood dyscrasia, malignancy, or infected bone graft or prosthesis.

The only absolute contraindication to the procedure is the absence of central venous access, such as occluded jugular veins or very small jugular veins rendering catheter insertion impossible. Relative contraindications include skin infection at the jugular and anterior chest wall puncture sites and severely impaired coagulation parameters. Occasionally, in patients with blood dyscrasia, the platelet count cannot be corrected to above 50 $x10^9$ /L, despite repeated platelet replacement. In this situation, depending on the urgency and clinical indications, I will still perform the jugular puncture under ultrasound guidance, but with extreme caution to avoid puncturing the carotid artery.

PREPROCEDURAL ASSESSMENT

The patient fasted for 6 hours, and coagulopathy and thrombocytopaenia are corrected whenever possible. A peripheral venous access is set for sedatives and analgesics. While the patient is on the angiography table, ultrasound of both internal jugular veins is performed to make sure that they are patent. Whenever possible, the right internal jugular vein is chosen, because the venous course is less tortuous. The left internal jugular

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Submitted: 27 November 2001; Accepted: 17 December 2001.

vein is used if the right internal jugular vein is thrombosed, stenosed (especially patients who have had prior central catheter insertion), or too small in calibre. I do not recommend subclavian venous access as the first choice, because permanent subclavian catheters are associated with an increased risk of veno-occlusive disease,[1,2] higher rates of immediate complications, such as pneumothorax,[3] and higher rates of catheter fracture.[4]

Since the majority of our patients undergoing catheterisation have a compromised immune system, the angiosuite is kept scrupulously clean. This includes cleaning the floor with germicide cleaner and deodorant prior to the procedure. A plastic device is constructed and placed at the head end of the table to allow the patient to breathe more comfortably during the procedure. Preferably, the patient's hair is entirely covered with a disposable nurse's cap. The procedure is performed under full surgical scrub and aseptic technique. Preprocedural antibiotics are not routinely given. Most patients do not require intravenous sedation. A few mLs of 1% lignocaine hydrochloride are injected subcutaneously at the venous puncture site (neck) and another 10 to 20 mLs of 2% lignocaine hydrochloride mixed with adrenaline (1:200,000 dilution) is administered during the creation of the subcutaneous tunnel.

PROCEDURE

The Hickman catheter (Bard Access Systems, Salt Lake City, USA) is available as a set (Figure 1) consisting of the Hickman catheter (French 9.0 for double lumen, French 9.6 for single lumen), an 18-gauge single wall puncture needle, a 10 mLs plastic syringe, 3 mm J guidewire (0.035 inch diameter), plastic tunneller, and French 10 peel-apart sheath with vessel dilator. The catheter is constructed of specially formulated and

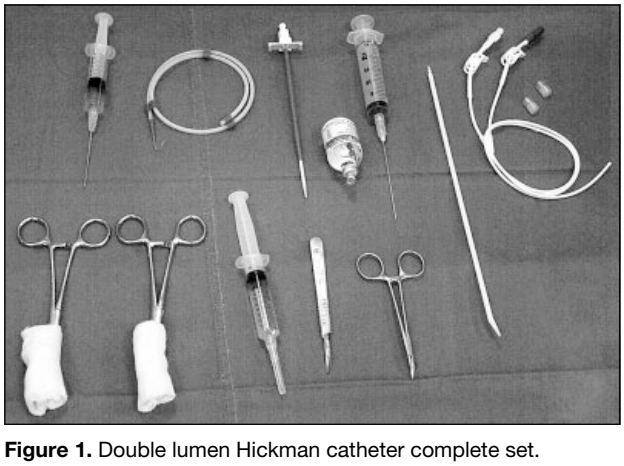

Figure 1. Double lumen Hickman catheter complete set.

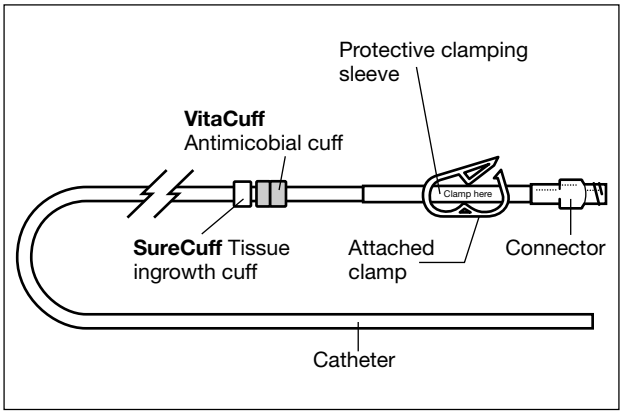

Figure 2. Single lumen Hickman catheter (reprinted with permission from Bard Access Systems, Salt Lake City, USA).

processed silicone (Figure 2). Each catheter is provided in a double sterile package.

The angiography table is tilted into Trendelenburg's position to decrease the potential risk of air embolism. The internal jugular vein is then punctured with the 18-gauge single wall puncture needle attached to a 10 mLs syringe half filled with saline under real time ultrasound guidance. A 10 MHz transducer is used. The needle is advanced into the vein about 1 to 2 cm above the clavicle under continuous transverse ultrasound scanning. Once the needle is in place, the J guidewire is advanced into the right atrium or inferior vena cava under fluoroscopy control. Manipulating the guidewire into the inferior vena cava not only secures the position of the guidewire, but also allows detection of inadvertent arterial puncture.

In the left jugular approach, manipulation of the J guidewire into the right atrium can be difficult, most likely because of the horizontally orientated left brachiocephalic vein. In this situation, a 3 mm (0.035 inch diameter) standard angled hydrophilic guidewire (Terumo Corporation, Tokyo, Japan) should be used instead. The French 10 peel-apart sheath, with the tip of the vessel dilator and J guidewire within, is then advanced and positioned at the junction of the superior vena cava and the right atrium.

The entry and exit sites of the catheter on the skin should be clearly marked and anaesthetised before creating the subcutaneous tunnel. The entry site is recommended to be at the para-midline of the chest wall on the ipsilateral jugular puncture site. In creating a subcutaneous tunnel for female patients, I recommend not to puncture in areas where underwear may potentially be worn, so as to avoid patient discomfort. The exit site is located

just lateral to the initial jugular puncture site, which is widened accordingly by a further 4 to 5 mm using a scalpel. Depending on the age and build of the patient, the subcutaneous tunnel is then anaesthetised with 10 to 20 mLs of 2% lignocaine mixed with adrenaline (1:200,000 dilution). A 4 to 5 mm skin opening is made at the entry site at the anterior chest wall before blunt dissection of the subcutaneous tract is performed using the plastic tunneller with the Hickman catheter firmly fitted at its end. The tunneller-catheter device is then threaded along the subcutaneous tunnel until the cuff is in the tunnel about 1 cm from the skin entry site.

The catheter length required is estimated using the 'bend-guidewire technique'. As the catheter length is estimated under image guidance, it is important to make sure that the tilting of the angiographic table and the C-arm of the radiographic unit are to the same degree and in the same direction, thus avoiding foreshortening of the Hickman catheter. The J guidewire-dilator complex, with the J guidewire extending beyond the dilator position, is advanced entirely into the venous system. The J guidewire is then removed and the patient is asked to hold his/her breath to avoid possible air embolism. The dilator is then flushed with heparinised saline and the syringe is left temporarily attached to the dilator. The catheter is then cut to the appropriate length and the catheter tip is cut at 45 degrees as recommended (N.B. for double lumen Hickman catheters, the smaller lumen should be cut shorter than the larger lumen). The vessel dilator with the syringe attached to its end is removed as a whole, leaving the peel-apart sheath in place. The patient is asked to perform the Valsalva manoeuvre to reduce the risk of air embolism. The catheter is inserted into the lumen of the sheath and advanced to the desired position under fluoroscopy guidance. The sheath is then completely peeled away from the catheter. The position of the catheter is verified under fluoroscopy and the last image is kept as a record (Figure 3).

Occasionally, difficulty in advancing the catheter through the peel-apart sheath may be encountered via the left jugular approach in elderly patients. This is because the peel-apart sheath may have become buckled due to the tortuous course of the left brachiocephalic vein. In this situation, inserting a 0.035 inch diameter standard angled guidewire into the Hickman catheter (into the larger lumen for double lumen catheters) to stiffen the catheter will be helpful to guide catheter positioning.

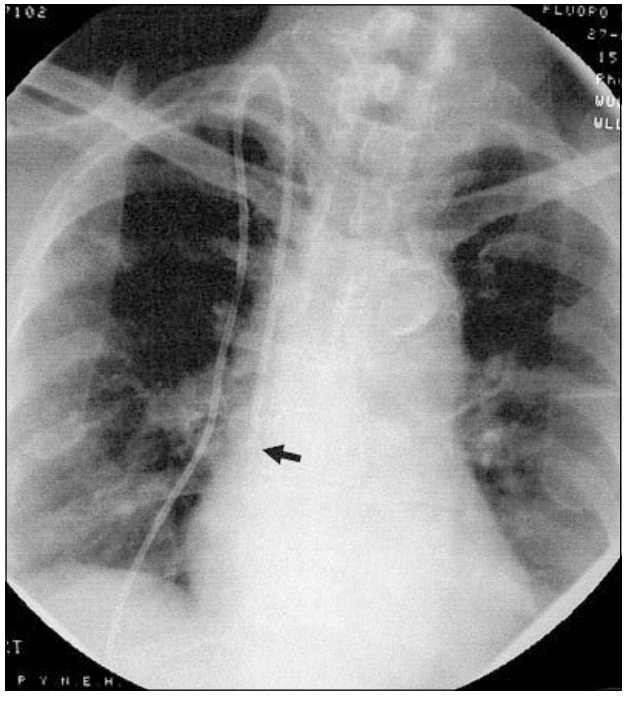

Figure 3. Fluoroscopic frozen image of the chest after insertion of a Hickman catheter. The catheter tip is at the junction of the superior vena cava and the right atrium (arrow).

After catheter insertion, blood is withdrawn from the catheter lumen(s) to ensure patency. The lumen(s) are additionally irrigated with heparinised saline and then the catheter is clamped. The angiography table is then tilted with the patient in the foot-down position to decrease bleeding at the jugular puncture before suturing. Sutures (3/O) are made at the jugular (usually 2 stitches) and anterior chest wall (usually 1 stitch) puncture sites, taking care not to damage the catheter. The external segment of the catheter should be coiled and taped. The patient is then educated to avoid tension on the external segment to prevent dislodging the catheter.

POSTPROCEDURAL MANAGEMENT

Bed rest for 4 hours with the patient a propped up in the 30-degree position is recommended. Immediate postprocedural chest radiographs are not routinely taken unless pneumothorax is suspected, thereby reducing the cost of patient care to the department.[5]

RESULTS

Successful tunnelled central catheter placement has been reported in 99.4%[6] and 100%[7] of cases. Docktor et al reported no immediate complications in 96% of patients, air embolism in 1.4%, haematoma in 0.2%, pneumothorax in 0.1%, and arterial puncture in 1.4%.[6] The apparently high rate of air embolism in this series

is likely to be the result of not positioning patients in Trendelenburg's position.

POTENTIAL COMPLICATIONS

The potential complications of Hickman central venous catheter insertion can be grouped under the following headings:

1. Immediate complications
   - Local/general* anaesthesia (allergy, side effects).
   - Cardiovascular system (inadvertent carotid artery puncture, haematoma, cardiac arrhythmia, air embolism).
   - Lungs (immediate and delayed pneumothorax, haemothorax).
   - Lymphatic system (thoracic duct injury).
   - Nerves (brachial plexus injury).

*Uncooperative patients.

2. Delayed complications
   - Cardiovascular system (thromboembolism, venous thrombosis, venous stenosis, endocarditis, cardiac perforation).
   - Catheter (catheter-related sepsis, exit site infection, exit site necrosis, catheter tip fracture).
   - Malposition or retraction, catheter or cuff occlusion, fibrin sheath formation.

CONCLUSION

Percutaneous insertion of Hickman central venous catheters via the jugular approach under imaging guidance in the angio-suite is a safe and effective procedure that is easy to perform. Among the advantages of jugular Hickman catheter insertions performed by an angiographer or interventional radiologist are re-usable venous access, generally shorter waiting times compared with surgical placement, lower cost, high technical success rate, and the fact that the procedure is well tolerated by most patients.

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