ORIGINAL ARTICLE

Insertion of Hickman Catheters by the Percutaneous Technique

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Summary

Hickman catheters have previously been conventionally placed by surgical dissection. This is usually performed by experienced surgeons and is carried out under general anaesthesia. We report our preliminary experience in Hickman catheter placement by percutaneous technique in twenty patients. We outline the implantation methods and complications encountered by this technique. The procedure is relatively simple provided the operator is skilled in central venous cannulation. The chief advantages are that the procedure can be done under local anaesthesia and results in less trauma compared with surgical dissection. Such an alternative in catheter insertion would promote wider usage of Hickman catheters in cancer patients.

Key Words: Hickman catheter

Introduction

The use of long term indwelling right atrial catheters in cancer patients was first described by Robert O. Hickman in 1979[1]. Hickman intravenous catheters are today an essential tool in the management of patients undergoing chemotherapy for malignant disorders. Vesicant drugs, such as anthracyclines and vinca alkaloids, as well as difficult venous access often necessitate the use of central venous lines. In addition to affording central venous access for infusion of drugs, intravenous fluids and blood products, Hickman catheters also allow easy access for blood sampling. The catheters, unlike ordinary central venous lines, can be kept in-situ for as long as necessary after the patient is discharged.

Hickman catheters have originally been inserted by surgical dissection. This involves obtaining vascular access by surgically exposing the cephalic vein or sometimes the internal jugular vein. Such a method requires surgical experience and may be difficult when the cephalic vein has been obliterated by phlebitis or difficult to locate as in obese patients. In 1982, Cohen and Wood described a modified method of catheter placement using the Seldinger technique[2].

Since then, this percutaneous method of catheter insertion has been increasingly popular. Prior to 1993, Hickman catheters in the University Hospital, Kuala Lumpur have been exclusively inserted by surgical dissection for both adult and paediatric patients.

We describe our initial experience in twenty adult patients who had Hickman catheters inserted by the percutaneous technique.

Patients and Methods

Between August 1993 and October 1994, we performed 20 Hickman catheter insertions by the percutaneous technique. Data concerning the indication, type of catheter, site of insertion, type of anaesthesia, and complications (procedural as well as post-operative) were recorded. The mean age of patients was 23 years (range 13-47 years).

Commercially available peel-apart percutaneous Hickman catheter sets were used (Davol, Bard Access Systems, 5425 West Amelia Earhart Drive, Salt Lake City, UT 84116 USA or Cook, P.O. Box 489 Bloomington, IN 47402 USA). The size of the catheters used were 9FG, 9.6FG and 12 FG. 12 were single lumen catheters and 8 were double lumen catheters.

All cases were performed by a member of the clinical haematology team. The procedure was performed in the operating theatre using aseptic techniques. C-arm fluoroscopy was utilised in all cases. The patients' coagulation profile and platelet counts were checked prior to the procedure and prophylactic platelet transfusions were administered if the platelet count was less than 50 x 10^9/l. All patients received IV Cefuroxime 1.5 g at the time of induction as antibiotic prophylaxis.

Implantation technique

After standard skin preparation and draping, the infraclavicular area is infiltrated with local anaesthesia. A 1-2 cm slip skin infraclavicular incision is made representing the entry site.

Percutaneous cannulation of the subclavian vein via the incision is then performed in the standard manner with the patient in the Trendelenberg position. A "J" guide wire is threaded intravascularly through the needle into the superior vena cava. The central position of the wire is confirmed by fluoroscopy.

Once venous access is accomplished, a 0.5-1cm incision representing the exit site is made about 10-15 cm inferior to the entry site. A subcutaneous tunnel is then made beginning from the exit site, using the tunneler provided by the manufacturer (Davol), and the catheter pulled up to emerge via the infraclavicular incision (Fig. 1).

A dilator and sheath are then passed over the guide wire into the subclavian vein (Fig. 2). The wire and dilator are removed and the catheter is then passed through the sheath which peels apart to allow the whole catheter to pass through (Fig. 3). The sheath is removed and the entry site is closed with nylon (Fig. 4). In patients undergoing general anaesthesia, the procedure is essentially the same except that the skin is not infiltrated with local anaesthetic.

A routine CXR was done for all patients to exclude pneumothorax and also to document the position of the catheter.

The exit site is dressed daily with bethadine and hydrogen peroxide solutions and the sutures at the entry site are removed ten days post-operatively.

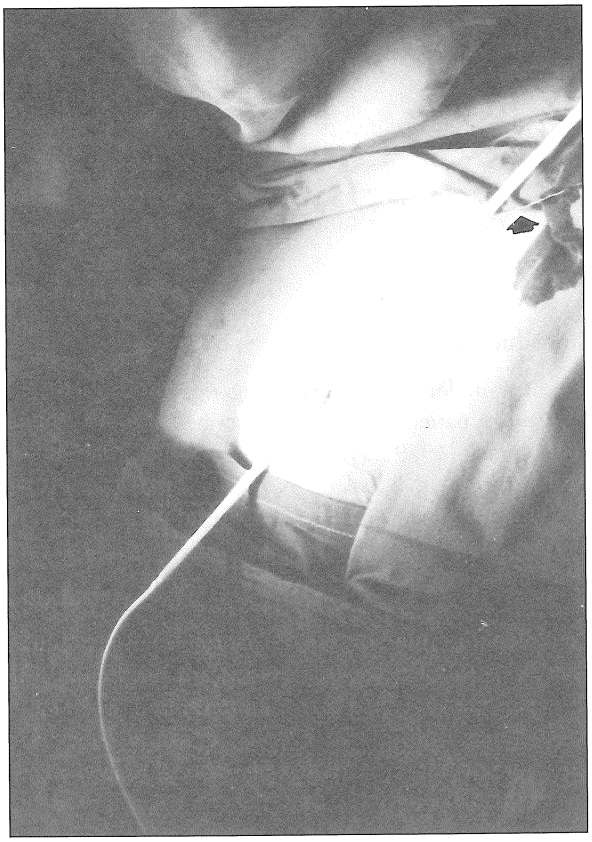

Fig. 1: Subcutaneous tunnel being made using tunneller with the Hickman catheter being pulled through from the exit site to the entry site. The guide wire which has been inserted earlier by the Seldinger technique is arrowed

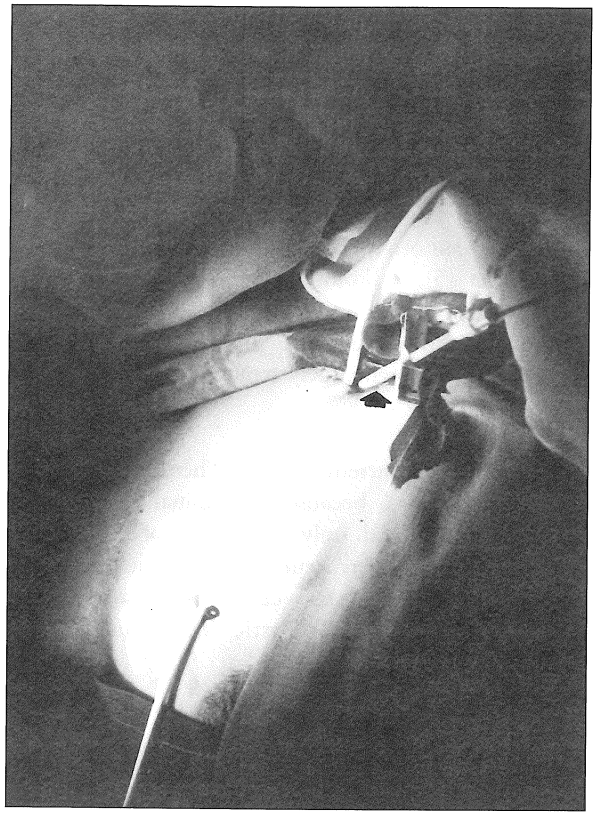

Fig. 2: Dilator and sheath (arrowed) inserted into the subclavian vein over the guide wire

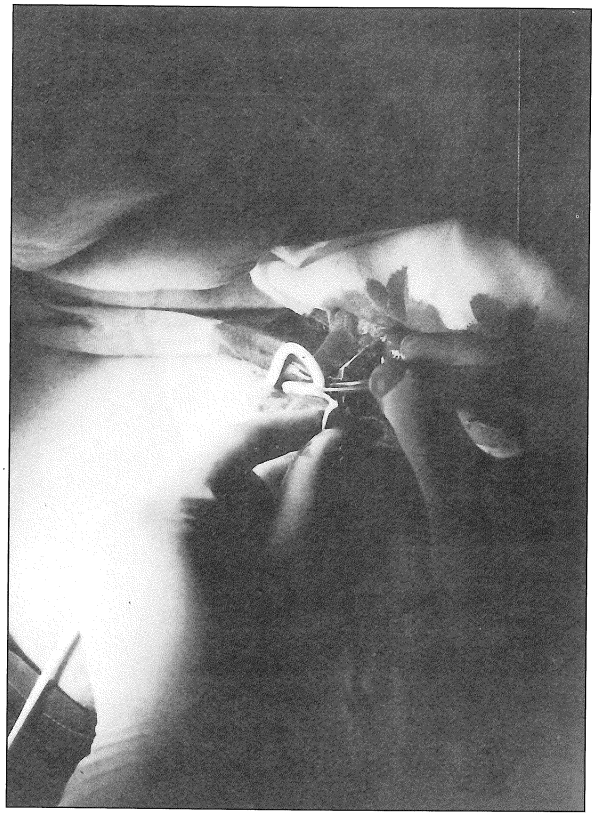

Fig. 3: Hickman catheter being threaded through the peel-apart sheath after the dilator and guide wire have been removed

Results

Implantation was attempted successfully under local anaesthesia in 9 out of 11 patients. 2 patients were unable to cooperate despite sedation and the procedure was then successfully done under general anaesthesia. The remaining 9 patients had the procedure done electively under general anaesthesia. The position of the catheter was satisfactory in all patients except in one patient with lymphoma in whom the catheter could not be advanced beyond the left innominate vein probably because of extrinsic compression from lymph nodes. The catheter in this instance was however fully functional. The preferential site of insertion was the left subclavian vein in 16 patients, and the right subclavian in 4 patients.

The diagnosis at the time of Hickman catheter insertion is listed in Table I.

The range of platelet counts at the time of insertion was 21-554 x 10^9/l with a mean of 161 x 10^9/l. 8 out of 20 patients required platelet transfusions prior

Table I
Diagnosis of patients at the time of Hickman catheter insertion

Diagnosis	Number of catheters
Acute myeloid leukaemia	7
Acute lymphoblastic leukaemia	6
Pre-bone marrow transplantation	5
Acute hybrid leukaemia	1
Hodgkin's lymphoma	1

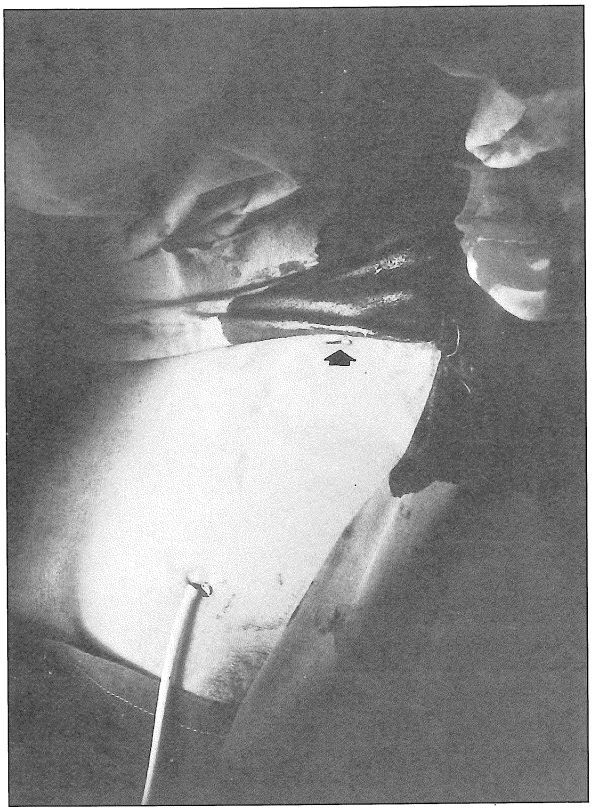

Fig. 4: Hickman catheter in-situ. Note the small entry site incision obtained with this procedure (arrowed). Skin closure is performed with a single mattress stitch using 3-0 Nylon

to the procedure and the mean platelet count for this group was 43 x 10^9/l . There were no serious bleeding complications encountered and only 2 patients had mild sanguineous ooze from the exit site following the procedure which resolved with conservative measures. The subclavian artery was inadvertently punctured in two patients but there was no bleeding noted in these two patients other than minor haematomas which quickly resolved. No incidence of pneumothorax occurred in the 20 patients.

Catheter related non-neutropaenic septicaemia developed in 5 patients. The organisms cultured in 5 patients are listed in Table II. All patients responded to antibiotics and survived the septic episodes but in all 5 the catheter was removed subsequently.

Other infections encountered were exit site infection (1), infected retained Dacron cuff (1) and thrombophlebitis (1).

The duration of catheter use for all 20 patients ranged from 22-238 days with a mean of 100 days. 7 out of the 20 catheters had to be removed prematurely. All 7 were because of septic complications (catheter related septicaemia (5), thrombophlebitis (1), septic shock during neutropaenia, organism not known (1)). The duration of catheter usage for those patients in which the catheter was prematurely removed was 56-157 days (mean 89 days).

13 patients are currently alive. There have been 7 deaths to date – 6 because of terminal refractory or relapsed disease and only 1 because of septicaemia occurring during severe neutropaenia (white cell count 0.5 x 10^9/l). The latter case was a patient with refractory acute lymphoblastic leukaemia and no organism was isolated.

Discussion

Although Hickman catheters have been in use for more than fifteen years now, in Malaysia, the use is still restricted to a few hospitals. One factor which is perhaps inhibiting wider usage of Hickman catheters is the availability of surgeons. This is not only considering experience in catheter placement by

Table II
Organisms isolated from blood culture in patients with catheter related septicaemia

Organism	Number
Staphylococcus epidermis (methicillin sensitive)	2
Staphylococcus epidermis (methicillin resistant)	1
Staphylococcus epidermis (methicillin resistant) and Diphtheroids	1
Enterobacter cloacae	1

surgical dissection but also the availability of operating time.

Percutaneous insertion of Hickman catheters is a relatively simple technique which persons skilled in central venous cannulation can readily perform. Using this technique, an uncomplicated procedure would take only about 20-30 minutes on the average.

Another major advantage with this procedure is that it can be done under local anaesthesia provided the patient is cooperative. This would require careful patient selection and probably precludes paediatric patients, but local anaesthesia avoids the inherent risks of general anaesthesia. Yet another advantage the procedure has over conventional surgical dissection is that the resultant entry site is much smaller (1-2 cm compared to 5-10 cm). This is beneficial not only in terms of cosmetic effect but also post-operative pain is usually less.

Disadvantages of the percutaneous technique compared with surgical dissection are chiefly the complications attributable to central venous cannulation. These are mainly pneumothorax and bleeding. Pneumothorax did not occur in our small series but in experienced hands, the incidence is less than 5%[3,4]. Provided the patient does not have a bleeding tendency which is not correctable with transfusion of blood products, bleeding following percutaneous insertion is not a major problem. Haematomas may result from inadvertent puncture of the subclavian artery as did happen in two of our patients but these usually do not result in clinically significant bleeding with the use of the 18 gauge introducer needle[5]. Occasionally one may have difficulty passing the catheter into the superior vena cava if unusual venous junction angles are present. In such instances, fluoroscopy is invaluable and the catheter may be manipulated into position perhaps with simultaneous injection of saline.

The use of Hickman catheters is not without problems and one must be aware of specific catheter related complications. These are summarised in Table III.

Infections remain the most common complication encountered. A dedicated and trained team of nurses is instrumental in keeping the infection rate to the minimum. In our series, local infection (entry, exit and tunnel sites) were not a big problem but proven bacteraemia occurred when patients were not neutropaenic in 5 out of 20 patients. In the absence of other sources of infection, these almost certainly represent catheter-related systemic infections and mandate catheter removal. From our series, such episodes of bacteraemia are usually due to gram-positive organisms chiefly staphylococcus epidermis. A significant proportion of these are resistant to methicillin thus one must be prepared to use antibiotics like Vancomycin quite early on.

Catheter dislodgment did not occur in any of our patients. We preferred the left subclavian vein as the site of insertion as this results in a longer portion of catheter remaining intravascularly, lessening the risk of complete dislodgment. Additionally the obliquity of the left innominate vein favours insertion compared with the sharper angle encountered with the right subclavian vein.

The other catheter related complications are less common but nevertheless physicians should be prepared to handle them should they arise.

On the whole, the advantages of Hickman catheters out-weigh the attendant complications. The ease of venous access offered by this simple device has revolutionised cancer chemotherapy over the last 15

Table III
Specific Hickman catheter related complications

1.	Infection
	exit site
	entry site
	tunnel
	systemic
2.	Blockage
3.	Dislodgment
4.	Air embolism
5.	Fracture and leakage
6.	Subclavian vein thrombosis/thrombophlebitis

years. We anticipate that as more physicians and nurses become accustomed to its use and handling the complications, the use of Hickman catheters in Malaysia will increase in the future. We also believe that the percutaneous technique of insertion being a simpler and less traumatic method is one reason which will facilitate the increased usage of Hickman catheters in the future.

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