Implantation of permanent jugular catheters in patients on regular dialysis treatment: ten years' experience

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ABSTRACT: Dual-lumen cuffed central venous catheter proved an important alternative vascular access compared to conventional arteriovenous (Cimino-Brescia) shunt in a selected group of patients on regular dialysis treatment. Typically, these catheters are used as bridging access, until fistula or graft is ready for use, or as permanent access when an arteriovenous fistula or graft is not planned (NKF-DOQI).

We conducted a prospective study on IJV permanent catheter insertion and its related earlier and long-term complications. From February 1991 to February 2001 we inserted in 124 patients in end stage renal disease 135 cuffed catheters (130 in the right IJV and 5 in the left IJV), 92 of which were Permcath, 27 Vascath, and 16 Ash-Split. We performed the insertion of catheters by puncturing the IJV under ultrasonographic guidance in the lower side of the Sedillot triangle and checking the accurate position of the tip by endocavitary electrocardiography (EC-ECG). The duration of catheter use was from 60 to 1460 days, mean 345 days. The actuarial survival rate at 1 year was 82%, at 2 years 56%, at 3 years 42% and at 4 years 20%. The exit site infection and septicemia rates were 5.2 and 2.86 per 1000 catheter days respectively. Catheter sepsis was implicated in the death of three patients, all of whom had multiple medical problems. Several episodes of thrombosis (6% of dialyses) occurred which required urokinase treatment, and catheter replacement in 12 patients (9.6%). In 3 cases the catheters were displaced and correct repositioning was performed. Two catheters (Ash-Split) were replaced due to accidental damage of the external portion of catheters (alcoholic disinfectant). Catheter tip embolism occurred on one occasion during elective catheter exchange over guide-wire.

One of the common problems encountered with cuffed tunneled catheters is poor blood flow, most often secondary to the formation of a fibrin sheath around the lumen. Even if we conducted a non-randomized study, in our experience, the higher rate of malfunctioning catheters was in the group with no anticoagulation therapy. Therefore, we suggest anticoagulation treatment in all patients wearing central vascular catheters with no contraindication. Just one year ago, we followed NKF-DOQI clinical practice guidelines for vascular access that indicated that for patients who have a primary AV fistula maturing, but need immediate hemodialysis, tunneled cuffed catheters are the access of choice and the preferred insertion site is the right IJV. Considering recent reports of permanent central venous stenosis or occlusion after IJV cannulation, currently, our first choice is femoral vein cannulation with smooth silicone rubber catheters, tunneled if long-term utilization is needed (more the 3-4 weeks). In our opinion, the right IJV puncture is to be avoided as much as the venipuncture of arm veins suitable for vascular access placement, particularly the cephalic vein of the non-dominant arm. Our data confirm that permanent venous catheters might represent an effective long-term vascular access for chronic hemodialysis, particularly for older patients with cardiovascular disease and for cancer patients. (The Journal of Vascular Access 2001; 2: 68-72)

KEY WORDS: *Vascular access, Dialysis, Jugular connulation*

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INTRODUCTION

Over the past decade, central venous catheters have increasingly become a permanent vascular access option for hemodialysis (HD) therapy. Long-term catheters have a cuff near the exit-site, which is separated from the venous insertion site by a subcutaneous tunnel. The cuff and the tunnel create physical barriers to infections, thus making long-term use possible. These catheters are usually used as bridging access until fistula or graft is ready for use, or as permanent access when an arteriovenous fistula (FAV) or graft is not planned (NKF-DOQI) (1).
HD catheters may be inserted in the jugular, subclavian or femoral veins. Subclavian catheters result in incidence of subclavian vein thrombosis (10-30%) and stenosis (40-50%) (2, 3). In the last few years, the internal jugular vein (IJV) has been preferred because of a lower rate of complications, and cannulation is done using three different techniques: surgical cut down technique, percutaneous Seldinger technique (preferred by most non-surgical clinicians) performed "blind" or with real-time ultrasound guidance (4-7). Some studies report good results using the cuff tunneled dual-lumen catheters (Quinton Permcath) (4, 5, 8, 9) or permanent twin catheters inserted in IJV (10, 11).
We conducted a prospective study on IJV permanent catheter insertion and its related earlier and long-term complications using our technique (12).

PATIENTS AND METHODS

From February 1991 to February 2001, we inserted in 124 patients in end stage renal disease (68 male, 65 female; mean age 72 years, range 19- 92 years, diabetics no. 32) 135 cuffed catheters, (130 in the right IJV e 5 in the left IJV) 92 of which were Permcath (Quinton Instrument Company, Seattle, USA), 27 Vascath (Bard, Salt Lake City, USA) and 6 Ash-Split (Medcomp, USA). Catheters ranged in length from 36 to 40 cm.
The catheter option was preferred because of:
1) exhausted peripheral access (5 cases);
2) limited life expectancy (39 cases);
3) AV fistula or graft maturing (68 cases);
4) peripheral access contraindicated (12 cases).

Procedure

We performed the insertion of catheters by puncturing the IJV under ultrasonographic guidance in the lower side of the Sedillot triangle, and checking the accurate position of the tip by endocavitary electrocardiography (EC-ECG). We collocated the venous tip in the atrium (diphasic P wave) and the arterious tip in the superior cava at the level of the atrio-caval junction (deep negative P wave). The procedures were done using strict aseptic technique under local anesthesia. The vein was cannulated using the Seldinger technique and the catheter was inserted using a peel-away sheath. It is useful to make a small surgical incision where the guide-wire penetrates the skin and to pass rigid dilators over the guide-wire. This will allow the peel-away sheath to pass more smoothly over the guide-wire. Great care should be taken when using dilators and peel-away sheath there, and they should be not pushed too far down the vein to avoid trauma to the vessel wall. Guide-wire position is confirmed by octopi on the cardiac monitor, or the ability to pass all but 5-10 cm of the guide-wire through the needle, or by EC-ECG via guide-wire. After insertion of the guide-wire we performed caudo-cranial tunnelization using a stylet. The tunnel should be short enough to keep the hub of the catheter from entering the exit site, yet long enough to keep the cuff at least 2 cm from the exit site.

Management of catheters during dialysis

During dialysis the catheters were handled aseptically. At the start of a session, 10 ml of blood were withdrawn from both limbs. Ease of aspiration was noted and a visual inspection of the aspirate was made for blood clots. After connection to the extracorporeal circuit, blood flows of 250-300 ml/min were sought. If flow was < 200-150 ml/min, the arterial and venous limbs of the catheter were reversed (reverse hoop-up). If this did not prove satisfactory, urokinase was administered as a bolus to the affected limb and left *in situ* for 20-30 min. (5000 UI made up to the exact volume of the affected limb). If there were inadequate blood flows, repeated urokinase bolus infusions were performed. The patient underwent a catheterographic film if fibrin sleeve was suspected. Ninety percent of subjects were under systemic anticoagulation therapy.
At the end of dialysis, both limbs of the catheter were flushed with 10 ml of normal saline and then filled with the appropriate volume of concentrated heparin, usually 5000 U/ml, which was then left *in situ* until the next dialysis.
Sutures are placed to secure the catheter at the exit site while waiting for adhesion of the Dacron cuff.

Catheter removal or substitution

The procedure was performed under local anesthesia with the patient in the Trendelemburg position. A small incision was made near the cuff in the Sedillot triangle. The Dacron cuff was dissected away from surrounding tissues and once free, the catheter was transected on its exit site and was easily withdrawn in two pieces. This technique was used to replace catheter over guide-wire introduced in the venous limb.

Statistics

Actuarial life table analysis was performed to determine catheter survival. We excluded the electively removed catheters and non-catheter related death. The catheters were considered a failure if removed for sepsis, poor flow or thrombosis, or if there was a catheter-related death.

RESULTS

Duration of use and catheter survival

The duration of use was from 60 to 1460 days, mean 345 days (Tab. I).
The catheter survival is shown in Figure 1.
The actuarial survival rate at 1 year was 82%, at 2 years 56%, at 3 years 42% and 4 years 20%.

COMPLICATIONS

Infections

The exit site infection and septicemia rates were 5.2 and 2.86 per 1000 catheter days respectively.
Catheter sepsis was implicated in the death of three patients, all of whom had multiple medical problems. In two cases the catheter was utilized for total parenteral nutrition with hypertonic glucose solution.

Inadequate blood flow

Several episodes of thrombosis (6% of dialyses) occurred which required urokinase treatment and, in 12 patients (9.6%), catheter replacement. Two catheters were removed due to the development of central venous thrombosis. Both patients had multiple previous subclavian dialysis catheters placed percutaneously. Both patients were transferred to peritoneal dialysis.

Other complications

In 3 cases the catheters were displaced and correct repositioning was performed. Two catheters (Ash-Split) were replaced due to accidental damage of external portion of catheters (alcoholic disinfectant). Catheter tip embolism occurred on one occasion during elective catheter exchange over guide-wire.

DISCUSSION

The advantages of tunneled cuffed venous catheters for vascular access (NKF-DOQI 2000) are the universal applicability, ability to be inserted into multiple sites, maturation time not required, venipuncture not required, no hemodynamic consequences, ease of catheter placement and replacement, ability to provide access over a period of months, and ease of correcting thrombotic complications. The disadvantages are the high morbidity due to thrombosis and infection, risk of permanent central venous stenosis or occlusion, discomfort and cosmetic disadvantages of an external appliance, shorter expected use-life than other access types, and lower blood flow rates, which will require

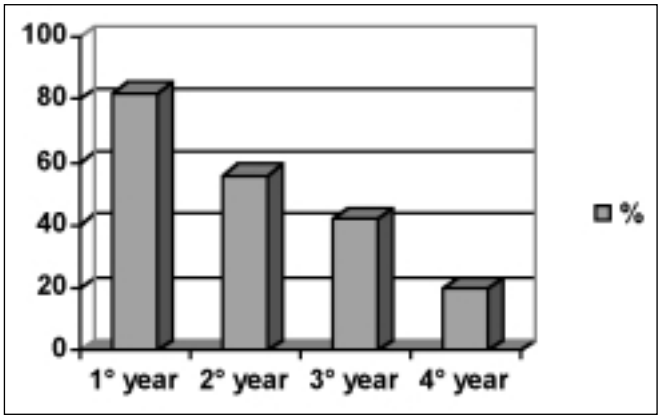

Fig. 1 - Catheter survival.

TABLE I - DURATION OF USE OF CATHETER

Period (months)	Number of catheters
0-12	52
12-24	34
24-36	16
26-48	8

longer dialysis times. We noticed no significant differences in survival rates and clinical outcomes of various catheter types. Therefore, in our opinion, currently there are no proven advantages of one cuffed catheter design over another. Catheters capable of a rapid blood flow rate are preferred. Catheter choice should be based on local experience, goals for use, and cost.

One of the common problems encountered with cuffed tunneled catheters is poor blood flow, most often secondary to the formation of a fibrin sheath around the lumens (13). In an autopsy series, a fibrin sheath was present in all patients after their long-term central venous catheters were removed (14). In a randomized prospective trial, low-dose warfarin (1 mg/day) has been shown to reduce thrombotic complications in cancer patients receiving chemotherapy with central venous catheters, and in patients receiving total parenteral nutrition (15). In a recent report (16), low-dose warfarin did not determine prolonged survival in a group of patients with dual-lumen venous dialysis catheters compared with a group of non-treated patients. Similar findings were also reported in another study (17). A significant reduction of thrombotic events with prophylactic use of aspirin at antiaggregant dosage (18) and with high-dose warfarin was reported (19, 20).

Even if we conducted a non-randomized study, in our experience, the higher rate of malfunctioning catheters was in the group with no anticoagulation therapy**.** Therefore, we suggest anticoagulation treatment in all patients wearing central vascular catheters with no contraindication.

We consider appropriate a trial of full-dose warfarin to assess whether any benefits, in terms of catheter survival, outweigh the increased risk of hemorrhagic problems associated with full-dose warfarin.

Just one year ago we followed NKF-DOQI clinical practice guidelines for vascular access (1997-2000) which indicated that for patients who have a primary AV fistula maturing, but need immediate hemodialysis, tunneled cuffed catheters are the access of choice and the preferred insertion site is the right IJV. Considering recent reports of permanent central venous stenosis or occlusion after IJV cannulation, currently our first choice is femoral vein cannulation with smooth silicone rubber catheters, tunneled if long-term utilization is needed (more than 3-4 weeks). In this matter we preserve right IJV for permanent vascular access, particularly in patients who have undergone multiple AV access insertions and in whom additional sites of AV access insertions are not available, or in patients in whom CAPD is not indicated. In our opinion, the right IJV puncture is to be avoided as much as the venipuncture of arm veins suitable for vascular access placement, particularly the cephalic vein of the non-dominant arm. The dorsum of the hand should be used for intravenous lines in patients with chronic kidney disease.

The utilization of central vein catheters for total parenteral nutrition because of high risk of infections and catheteral and pericatheteral thrombosis (21), should be avoided.

Our data confirm that permanent venous catheters might represent an effective long-term vascular access for chronic hemodialysis, particularly for older patients with cardiovascular disease and for cancer patients.

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