Translumbar Inferior Vena Cava Catheter for Long-Term Hemodialysis

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ABSTRACT

Vascular access failure is a major cause of morbidity and even mortality in patients on chronic hemodialysis. The failure of conventional vascular access and thrombosis of the superior vena cava in a patient with ESRD was successfully treated by the percutaneous insertion of a hemodialysis catheter directly into the inferior vena cava. The translumbar access to the inferior vena cava has been used successfully in bone marrow transplant recipients and may also be used as a last choice for long-term hemodialysis when conventional access is difficult.

Key Words: Hemodialysis, vascular access inferior vena cava, catheter

Vascular access complications contribute increasingly to the cumulative morbidity and even mortality in chronic hemodialysis patients (1). The endogenous arteriovenous fistulae and grafts are preferred for vascular access, but central venous catheters are required frequently as temporary or permanent solutions for difficult access problems (1). Cuffed central venous catheters are usually placed in the jugular or subclavian veins and are comparable to grafts in longevity (2), but may fall as the result of thrombosis. Eventually, these patients may present with thrombosed hemodialysis accesses and central veins. We were presented with such a patient who had superior vena cava occlusion, for whom the placement of a conventional vascular access in the thigh was not feasible. Under these circumstances, indwelling cuffed femoral vein catheters have been successfully used in ambulatory hemodialysis patients (3,4). Because indwelling femoral catheters are uncomfortable and more likely to interfere with mobility, we used a novel translumbar approach to inferior vena cava circulation for hemodialysis access.

CASE REPORT

History

A 63-yr-old man with diabetic nephropathy began hemodialysis in 1992. He had diffuse atherosclerosis involving the peripheral, cerebral, and coronary vasculature. The placement of polytetrafluoroethylene accesses for chronic hemodialysis, first in the left forearm and later in the right thigh, was complicated by vascular steal, leading to claw hand and foot drop, respectively. Therefore, the accesses were surgically ligated, and the placement of a similar access in other sites was considered too risky. Hemodialysis was continued with a PermCath dual lumen catheter (Quinton Inc., Seattle, WA) in the subclavian veins, first on the left and then the right side. In 1993, radiation therapy to the chest was instituted for bronchogenic carcinoma. Over the next few months, prominent venous collaterals developed over the anterior chest wall. In June 1994, the right subclavian hemodialysis catheter was removed because of inadequate blood flow. Further attempts at the placement of hemodialysis catheters in either subclavian veins were unsuccessful. Upper extremity venograms showed occlusion of the subclavian veins on either side (Figure 1). An attempted transfemoral superior vena cavaogram revealed superior vena cava occlusion. Occlusion of the subclavians veins and superior vena cava was attributed to previous hemodialysis catheters in the subclavian veins and radiation therapy to the chest for bronchogenic carcinoma. Peritoneal dialysis was not a feasible alternative to maintainance hemodialysis, because the patient's manual dexterity was limited by a claw hand and his social situation did not permit dialysis at home. Therefore, the options were limited to hemodialysis with a catheter in the inferior vena cava or the veins draining into it. The usual practice in such cases has been to insert catheters through the femoral veins and tunnel the proximal end into the thigh or the anterior abdominal wall (5,6). Interference with ambulation and infections are major problems associated with indwelling femoral catheters. Despite numerous medical problems, the patient was ambulatory and drove himself to the dialysis unit regularly. Therefore, the femoral approach was deemed undesirable. Our experience with the percutaneous placement of Hickman catheters directly into the inferior vena cava in bone marrow transplant recipients prompted a similar approach for hemodialysis access in this patient.

Procedure

A 40-cm-long PermCath dual lumen catheter (Quinton Inc.; catalog no. 17681-001) was selected for
Figure 1. Left upper extremity venogram showing occlusion of the left subclavian vein with the development of collaterals. Similar findings were seen on the right side.

Percutaneous placement directly into the inferior vena cava by a translumbar approach. The catheter measured $5.9 \times 3.3$ mm in transverse dimensions externally. The internal diameter of the two circular lumens was $2.0$ mm each. The patient was placed in the left lateral decubitus position, and conscious sedation was administered intravenously. With the patient under local anesthesia, an 18-gauge needle was advanced into the infrarenal vena cava from a posterolateral point just above the iliac crest, 8 to 10 cm from the midline. The needle was exchanged for a 5-French straight end-hole catheter over a 0.035-inch extra-stiff amplatz wire, under fluoroscopic guidance. A subcutaneous tunnel was then created with a semi-rigid tunneling device (Davol Tunneller, Davol Inc., Cranston, RI). From the initial posterolateral to a lateral subcostal skin entry point. The catheter was tunneled from the lateral subcostal point (Figure 2) to the posterior entry point subcutaneously. The percutaneous inferior vena cava tract was dilated with progressive dilators up to 18 French over the 0.035-inch extra-stiff amplatz wire. An 18-French peel-away sheath was then advanced into the inferior vena cava. The amplatz wire was removed, and the PermCath was advanced through the peel-away sheath into the inferior vena cava. The sheath was peeled away, and skin entries were then sutured. The catheter was flushed immediately with 1,000 U of heparin. A radiograph shows the position of the catheter in the inferior vena cava (Figure 3). The procedure was performed under fluoroscopic guidance, to ensure the optimal placement of the catheter and the positioning of the catheter tip. Furthermore, fluoroscopy helps in detecting and correcting any kinks along the course of the catheter. Real-time ultrasound may also be useful in providing easier access to the inferior vena cava.

Figure 2. Patient's frontal profile showing catheter exit site in the subcostal region.
DISCUSSION

The technique of inferior vena cava catheterization was originally described by Kenney et al. (7). It has been used for stem cell collection by apheresis, bone marrow transplantation, and parenteral nutrition (8). We have placed single-lumen Hickman catheters in the inferior vena cava in over 60 patients requiring plasma apheresis for bone marrow transplantation. We used a similar technique to percutaneously place a cuffed dual-lumen hemodialysis catheter directly into the inferior vena cava. A shorter length of the catheter presented a minor problem that forced us to use a lateral exit site, rather than the usual anterolateral site on the abdominal wall. Furthermore, the tip of the catheter lay opposite the L1 vertebral body, rather than the atrio caval junction. These problems can be overcome by the use of longer, double-lumen hemodialysis catheters, which are now available up to 45 cm in length (PermCath, Quinton Inc.). The catheter was not associated with any complications, discomfort, or interference with activities of daily living. This is the first report of using translumbar inferior vena cava access for hemodialysis, but sufficient experience has been gained in using this approach for the insertion of cuffed, single-lumen catheters in bone marrow transplant recipients. Insufficient blood flow due to thrombosis has been reported to occur in up to 25% of these catheters and can be effectively treated with urokinase (9). Mechanical dysfunction as the result of spontaneous change in the position of the catheter has been effectively treated by guidewire repositioning or replacement of the catheter (9).

In conclusion, the technique of placing wide lumen catheters percutaneously in the inferior vena cava for a variety of uses is becoming known to hematology and oncology services, particularly those working with bone marrow transplant patients, but is not yet widely known to nephrologists, who often face the difficult problem of venous access. The percutaneous placement of a subcutaneously tunneled, double-lumen hemodialysis catheter directly into the inferior vena cava, by an experienced interventional radiologist, may be the most practical last choice for vascular access under these circumstances.

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REFERENCES

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