Renal Vein Access

Percutaneous transrenal placement of a tunneled dialysis catheter is feasible in some patients who have exhausted their traditional venous access sites.

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Maintaining long-term function of venous access is a common problem for patients with end-stage renal disease, short-gut syndrome, and those chronically dependent on total parenteral nutrition. When traditional access sites are exhausted due to infection, thrombosis, or stenosis, alternative venous access sites must be sought. We report a successful transrenal approach in a patient needing dialysis with no alternative percutaneous routes for venous access.

A 62-year-old woman with a history of scleroderma and chronic dependence on total parenteral nutrition for the previous 23 years due to malabsorption was admitted to our institution for anasarca and management of her acute renal failure after being transferred from a peripheral hospital. She presented with asterixis and was fluid overloaded. The etiology of the patient's renal failure was uncertain. The patient therefore underwent a renal biopsy, which demonstrated arteriolar nephrosclerosis. Because of the fluid overload and electrolyte abnormalities, she required emergent dialysis.

She was referred to interventional radiology for further work-up and placement of a tunneled dialysis catheter after unsuccessful attempts by the nephrology service. Initial ultrasound of the neck demonstrated occluded bilateral internal/external jugular veins. A venogram was performed via a collateral neck vein demonstrating occlusion of the brachiocephalic veins (Figure 1). The multiple small collateral veins were too small and tortuous for subsequent placement of a large-bore dialysis catheter. She was also assessed for placement of a translumbar catheter. A pelvic and inferior vena cava (IVC) venogram performed from both common femoral veins demonstrated complete occlusion of the proximal common femoral, external, and common iliac veins bilaterally. Additionally, the infrarenal IVC was occluded and not opacified from both groin punctures to the level of the renal veins. There were mature pelvic collateral vessels that drained into a large left gonadal vein and multiple lumbar collaterals (Figure 2), which

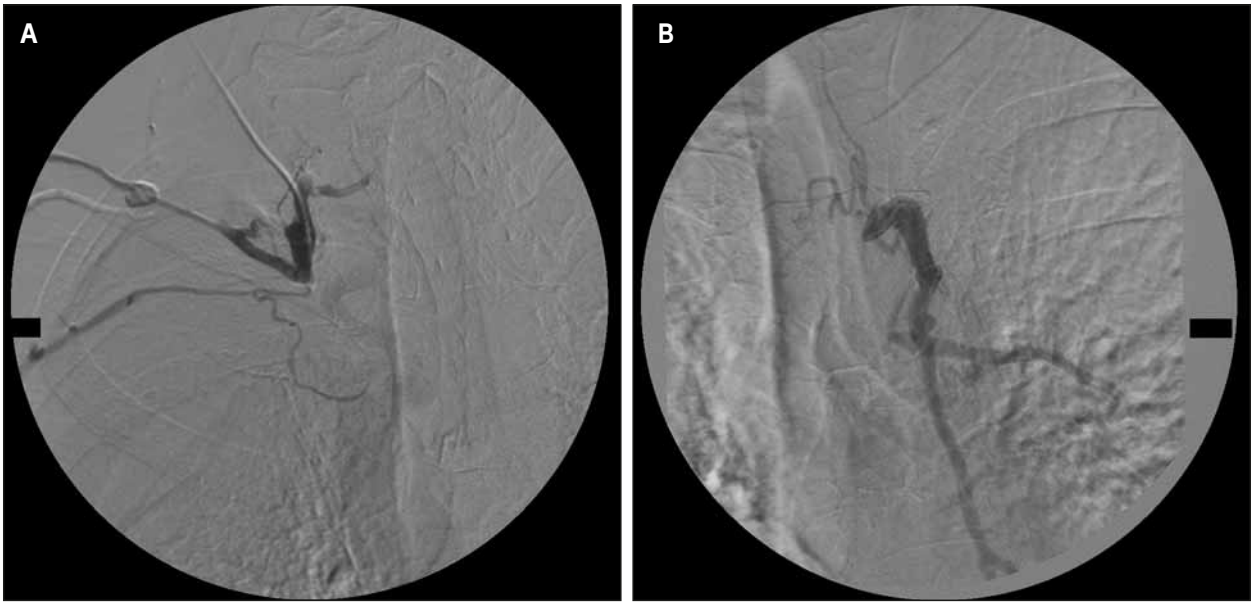

Figure 1. Right (A) and left (B) internal jugular venograms in a patient with chronic occlusion of her central veins secondary to chronic total parenteral nutrition access. The venograms demonstrate opacification of collateral neck veins and the hemiazygous vein.

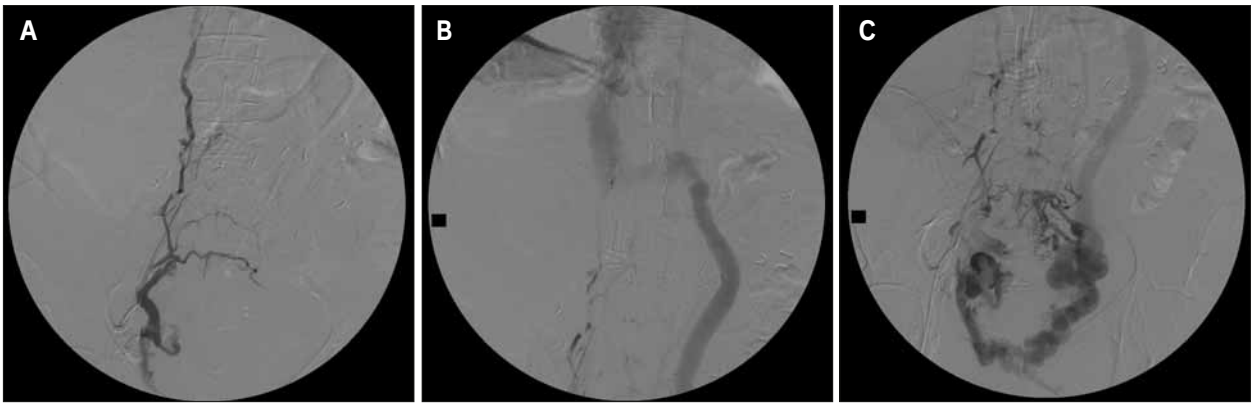

Figure 2. Pelvic venograms from right and left common femoral vein access using 5-F micropuncture sheaths. Pelvic venograms showed complete occlusion of the right and left common iliac and external iliac veins, with opacification of the right paravertebral collateral channels (A). Pelvic and ovarian varicoceles opacified with drainage primarily via the left renal vein to the IVC (B) and (C).

subsequently drained into the left renal vein and eventually to the suprarenal IVC.

The patient had an existing small-bore peripheral inserted catheter that was placed via the right groin femoral approach at an outside institution. Catheter-directed total parenteral nutrition is the suspected etiology for chronic occlusion of the upper and lower venous structures. Because of the central and pelvic venous occlusions, she was not a candidate for traditional temporary or permanent dialysis catheter access. Her ultrasound (US) study showed that both her kidneys were small and atrophic. Because she was not a candidate for translumbar catheter placement and her acute chronic renal failure, a decision was made to attempt insertion of a transrenal catheter for emergent hemodialysis.

THE PROCEDURE

The risks, benefits, and alternatives of this procedure were discussed with the patient and family, and informed consent was obtained. The Institutional Review Board determined that the project met criteria for exemption from review. The procedure was performed under general anesthesia, as per the patient's request. The procedural steps involved have been described by Murthy et al.[1]

The patient was positioned in the prone position on the angiography table. Both flanks were prepared and draped in the usual sterile fashion. The left kidney was chosen as the target. On the pelvic and IVC venogram (Figure 2), the right renal vein was not visualized and presumed occluded. Using real-time US (ATL HDI 5000, Philips, Bothell, WA), the left mid kidney was identified and a 22-gauge Chiba needle was advanced into the renal parenchyma. Utilizing fluoroscopic guidance, a small amount of contrast was administered through the 22-gauge needle and a segmental draining interpolar vein was opacified. Additional contrast was administered through the small interpolar venous structure and a venogram was obtained, which showed opacification of the left main renal vein and suprarenal IVC (Figure 3). A V18 .018-inch guidewire (Boston Scientific Corporation, Natick, MA) was then manipulated into the suprarenal IVC. The needle was then removed and the inner dilator of a Neff percutaneous access set (Cook Incorporated, Bloomington, IN) was placed. An additional venogram was performed by injecting the side arm of a Touhy-Borst adaptor, which showed satisfactory access for the dialysis catheter placement. The Neff system was then reassembled and advanced over the .018-inch guidewire into the suprarenal IVC. The guidewire was then exchanged for an Amplatz stiff wire that was positioned within the mid-right atrium.

The skin and subcutaneous tissue along the midaxillary line was anesthetized and a small skin incision was made. A tunnel device was advanced from the mid-axillary incision through to the access site within the left posterior flank. The access site was serially dilated and a 14-F peel-away sheath (Cook Incorporated) was placed into the IVC. A 50-cm, 13.5-F, dual-lumen silicone hemodialysis/apheresis catheter was placed via the peel-away sheath such that the tip of the catheter terminated at the mid-right atrium (Figure 4). Two stiff Glidewires (Terumo Medical Corporation, distributed by Boston Scientific Corporation) were also used to direct the catheter to the right atrium. Hemostasis was achieved using manual compression, and the catheter was then secured with sutures. Each lumen was flushed

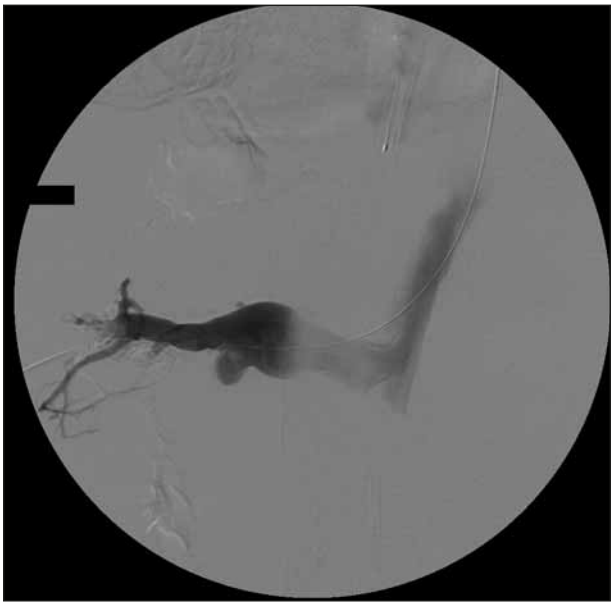

Figure 3. Left renal venogram obtained via an interpolar vein shows opacification of a patent main left renal vein and suprarenal IVC (prone position).

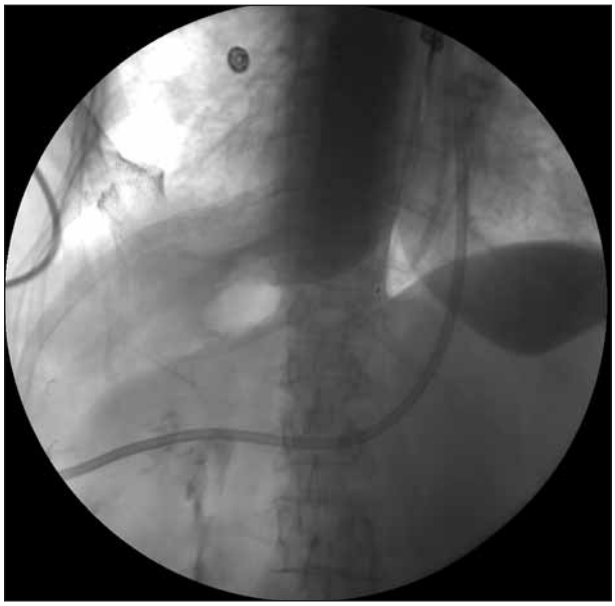

Figure 4. Placement of a 50-cm dialysis catheter with the tip positioned at the mid-right atrium (prone position).

and aspirated without difficulty. The patient recovered uneventfully and had successful hemodialysis the next day.

The catheter functioned well for 4 months, after which the patient died of other causes.

DISCUSSION

Maintaining long-term function of venous access is a common problem for patients with end-stage renal disease, short gut syndrome, and those who are chronically dependent on total parenteral nutrition. Intravenous access sites in these patients frequently become exhausted either due to thrombosis or infection. In this patient, access sites became problematic because she was chronically dependent on total parenteral nutrition due to the malabsorptive state from her scleroderma. Her medical condition became emergent when she was admitted to the hospital requiring dialysis for renal failure. The traditional favored sites for central venous access were occluded. The right internal jugular vein is preferred because of the low incidence of venous thrombosis and stenosis.[2] Other venous access sites such as the subclavian,[3,4] femoral,[5] translumbar infrarenal IVC,[6] hepatic,[7] and hemiazygous, and azygous veins[8] have been described. Recanalization of these occluded segments has also been described.[9-11]

In this patient, all traditional percutaneous access sites were occluded. Although the suprarenal IVC was patent, it was small and therefore technically challenging to percutaneously access, especially without a target. Because of the patient's atrophic kidneys and emergent dialysis condition, a transrenal approach was chosen. It was deemed that this approach was preferable because her kidneys were nonfunctional. Placement of arteriovenous fistulas or polytetrafluoroethylene grafts was not feasible in this patient because of her venous occlusions. Percutaneous placement of a hemodialysis catheter via the transrenal route has been described by Murthy et al in a similar clinical setting in a patient who has limited access sites and who was chronically dependent on hemodialysis.[1] There has also been a successful case of open surgical transrenal vein access in the pediatric population.[12] To our knowledge, this is the second case of percutaneous placement of a hemodialysis catheter via the transrenal approach.

Although injury to the renal parenchyma is not an issue in patients with small and atrophic nonfunctioning kidneys, the procedure is associated with an attendant risk of arterial injury; therefore, the possibility of emergent arterial embolization exists. This is clearly discussed during the informed consent process with the patient prior to the procedure. Not knowing the incidence of arterial injury associated with this procedure, Murthy et al have suggested extrapolating data on experience from biopsy of native and transplant kidneys which reported an incidence of arteriovenous fistulas from renal biopsy ranging from 0.3% to 19%.[13,14]

CONCLUSION

Percutaneous placement of a hemodialysis catheter via the transrenal approach is technically feasible in the appropriate clinical setting, in patients who have exhausted their traditional venous access sites. However, the attendant risk of arterial and visceral injuries exists; therefore, further experience with this approach is needed to establish the overall risk versus benefit ratio. ■

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1. Murthy R, Arbabzadeh M, Lund G, et al. Percutaneous transrenal hemodialysis catheter insertion. J Vasc Interv Radiol. 2002;13:1043-1046.
2. Macdonald S, Watt AJB, McNally D, et al. Comparison of technical success and outcome of tunneled catheters inserted via the jugular and subclavian approaches. J Vasc Interv Radiol. 2000;11:225-231.
3. Sunrrat RS, Picus D, Hicks ME, et al. The importance of preoperative evaluation of the subclavian vein in dialysis access planning. Am J Roentgenol. 1991;156:623-625.
4. Barret N, Spencer S, Melver J, et al. Subclavian stenosis: a major complication of subclavian dialysis catheters. Nephrol Dial Transplant. 1988;3:423-425.
5. Friedman B, Kanter G, Titus D. Femoral venous catheters: a safe alternative for delivering parenteral nutrition. Nutr Clin Pract. 1994;9:69-72.
6. Kinney TB. Translumbar high inferior vena cava access placement in patients with thrombosed inferior vena cava Filters. J Vasc Interv Radiol. 2003;14:1563-1568.
7. Stavropoulos SW, Pan JJ, Clark TW et al. Percutaneous transhepatic venous access for hemodialysis. J Vasc Interv Radiol. 2003;14:1187-1190.
8. Patel N. Percutaneous translumbar placement of a Hickman catheter into the azygous vein. Am J Roentgenol. 2000;175:1302-1304.
9. Horton MG, Mewissen MW, Rilling WS, et al. Hemodialysis catheter placement directly into occluded central vein segments: a technical note. J Vasc Interv Radiol. 1999;10:1059-1062.
10. Funaki B, Zaleski GX, Leef JA, et al. Radiologic placement of long-term hemodialysis catheters in occluded jugular or subclavian veins or through patent thyrocervical collateral veins. Am J Roentgenol. 1998;170:1194-1196.
11. Ferral H, Bjarnson H, Wholey M, et al. Recanalization of occluded veins to provide access for central catheter placement. J Vasc Interv Radiol. 1996;7:681-685.
12. Dewan P, Penington E, Henning P, et al. Venous access via the renal vein: a technical innovation. Pediatr Surg Int. 1998;13:457-459.
13. Tarif N, Dunne P, Parachuru P, et al. Life-threatening hematuria from an arteriovenous fistula complicating an open renal biopsy. Nephron. 1998;80:66-70.
14. Silberzweig J, Tey S, Winston J, et al. Percutaneous renal biopsy complicated by renal capsular artery pseudoaneurysm. Am J Kidney Dis. 1998;31:533-535.