Externalization of Tunneled Hemodialysis Catheter in Patients with Tunnel or Exit-Site Infections and Limited Access Options

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ABSTRACT

Purpose: To evaluate the viability and effectiveness of temporary externalization of a tunneled hemodialysis (HD) catheter in catheter-dependent HD patients presenting with catheter-related tunnel or exit-site infection, documented central venous stenosis, and limited alternative venous access.

Materials and Methods: All catheter-dependent HD patients with known central venous stenosis presenting with exit-site or tunnel infection and who subsequently underwent catheter externalization between February 2008 and May 2012 were reviewed. After catheter externalization, patients were concurrently treated with antibiotics for approximately 3 weeks before reinsertion of a new tunneled catheter. Treatment outcomes were collected, with treatment failures defined as reinfection with the same organism within 45 days of tunneled catheter reinsertion.

Results: There were 42 catheter externalization procedures performed in 26 patients for 42 exit-site or tunnel infections. Technical success rate for catheter externalization was 100%, with no complications during the externalization procedure and preservation of all original access sites. Treatment failure occurred in 9.8% (4 of 41) of cases. Median infection-free survival after treatment and retunneling of a new dialysis catheter was 80 days. One major periprocedural complication of death occurred before reinsertion of a new tunneled catheter. Minor complications after the procedure occurred in four patients and included three cases of a small persistent wound at the temporary supraclavicular access site and one initially nonfunctioning externalized catheter.

Conclusions: Temporary dialysis catheter externalization appears both technically feasible and effective for the treatment of exit-site and tunnel infections, while allowing preservation of the venous access site in catheter-dependent HD patients with central venous stenosis and limited alternative venous access.

ABBREVIATIONS

HD = hemodialysis, IV = intravenous

Hemodialysis (HD) is the predominant modality of renal replacement therapy for patients with end-stage renal disease, with arteriovenous fistulas being the preferred access type. Despite national and international initiatives advocating the benefits of arteriovenous fistulas, the long-term use of tunneled dialysis catheters and the prevalence of catheter-dependent HD patients continue to increase (1–4).

Within this growing catheter-dependent population exists a subset of patients who have developed significant catheter-induced central venous stenosis, while exhausting conventional upper body venous access sites. These patients represent a significant treatment challenge when presenting with catheter-related infections. Initiation of antibiotic therapy with removal of the dialysis catheter

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risks permanent loss of the venous access site secondary to central venous stenosis and thrombosis (5). Alternatively, favorable results have been reported in a small group of patients with catheter-related bacteremia and either a tunnel or an exit-site infection who were treated with over-the-wire catheter exchange and creation of a new subcutaneous tunnel. These patients had a 75% cure rate, defined as a minimum symptom-free period of 45 days after antibiotic therapy with salvage of the initial venous access site (6). However, in our experience, creating a new subcutaneous tunnel in a location considered a safe distance away from the tunnel or exit-site infection can sometimes be challenging. The purpose of this study was to evaluate the viability and effectiveness of a technique of temporary catheter externalization of a tunneled HD catheter that allows for preservation of the primary venous access site during treatment of tunnel or exit-site infections in catheter-dependent HD patients with central venous stenosis and limited venous access options.

MATERIALS AND METHODS

Study Population

The study was approved by the research ethics board. Informed written consent for the procedure was obtained from all patients. A retrospective analysis of consecutive patients who had undergone catheter externalization between February 2008 and May 2012 was performed. There were 42 procedures performed in 15 men and 11 women with an average age of 57.1 years ± 17.5. The procedure was performed to treat 22 exit-site infections and 20 tunnel infections. Exit-site infections were defined as inflammation, exudate, or pain localized to the area surrounding the catheter exit site without extension superiorly beyond the cuff (2). Tunnel infections were defined as inflammation, exudate, or pain overlying the catheter tunnel superior to the cuff with or without exit-site drainage (2,6). Additional patient demographics are summarized in **Table 1**. Inclusion criteria were catheter-related infection of the subcutaneous tunnel or exit-site, or both, and angiographically proven central venous stenosis within the superior vena cava and brachiocephalic veins in catheter-dependent HD patients.

Before the externalization procedure, diagnostic central venography was performed in patients with clinical suspicion (ie, venous collateralization, difficulty with prior catheter insertions) of central venous stenosis or occlusion. Diagnostic central venography was performed via a bilateral peripheral arm vein technique or a previously functioning upper arm fistula before vascular access failure. Central venous balloon angioplasty was performed during the placement of the externalized catheter in patients with symptomatic venous stenosis (ie, arm or facial swelling) or declining catheter function. Central venous stenosis was defined as a reduction in luminal diameter of at least 75% on venography. Procedure complications were defined as per the Society of Interventional Radiology (SIR) Classification System for Complications by outcome (7).

Table 1. Demographic and Clinical Characteristics of Study Subjects

N	26
Age (y) (mean ± SD)	57.1 ± 17.5
Male sex, no. (%)	15 (57.7%)
Total HD duration (y) (mean ± SD)	7.7 ± 6.5
Catheter-dependent dialysis (y) (mean ± SD)	4.7 ± 2.2
Average total dialysis line insertions	9.6 ± 7.5
Temporary catheter dwell time (d) (mean ± SD)	21.6 ± 5.7
ESRD cause, no. (%)	
Diabetes	9 (34.6%)
Unknown	6 (23.1%)
Glomerulonephritis	2 (7.7%)
Other	9 (34.6%)

ESRD = end-stage renal disease; HD = hemodialysis.

Catheter-related infections were identified by the nephrology and vascular access team. Culture specimens were obtained from the catheter exit site and bloodstream in all cases on the day infection was clinically suspected and repeated after treatment. All patients diagnosed with a catheter-related infection were started on empiric antibiotic therapy that was subsequently modified based on culture sensitivities. The following empiric regimens for catheter-related infection were used as per the discretion of the nephrologist: intravenous (IV) vancomycin 15–20 mg/kg load with 8–10 mg/kg maintenance dose after HD, with doses adjusted based on levels with or without IV ceftazidime 2 g after HD; IV vancomycin in the same dosage as mentioned with or without IV gentamicin 2 mg/kg load with 1–2 mg/kg maintenance dose after HD adjusted based on levels; and IV cefazolin 20 mg/kg after HD rounded to nearest 500-mg dose (range, 1–2 g per dose) with or without IV gentamicin in the same dosage as mentioned. Antibiotics used based on culture sensitivities were as follows: IV cefazolin 20 mg/kg after HD three times weekly (range, 1–2 g per dose); IV vancomycin load of 15–20 mg/kg then dosed 8–10 mg/kg after HD (rounded to nearest 250-mg dose) with level before vancomycin every second HD and adjustment of vancomycin dose based on levels (if level 10–25 mg/L, dose is unchanged; if level $>$ 25 mg/L, dose is reduced by 250 mg; and if level $<$ 10 mg/L, dose is increased by 250 mg); IV gentamicin load of 2 mg/kg then 1–2 mg/kg after HD (dosed based on ideal body weight, possible limit of 100 mg per dose) with dose adjustment based on levels with trough level $<$ 2 mg/L drawn just before HD; IV ciprofloxacin 400 mg every 24 hours or 200 mg every 12 hours given after HD; oral ciprofloxacin 500 mg every 24 hours or 250 mg every 12 hours given after HD; oral or IV levofloxacin load of 750 mg then 500 mg every 48 hours given after