Excerpta Medica

The American Journal of Surgery

The American Journal of Surgery 190 (2005) 4–8
Clinical paper – American

Surgical salvage of peritoneal dialysis catheters from chronic exit-site and tunnel infections

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Manuscript received November 29, 2004; accepted manuscript December 31, 2004

Abstract

Background: Chronic exit-site and tunnel infections of the peritoneal dialysis catheter are significant causes of catheter loss. Surgical salvage procedures that can effectively resolve the infection and preserve dialysis are of major importance.
Methods: Thirteen patients with chronic exit-site and tunnel infections underwent surgical salvage consisting of unroofing the tunnel tract and shaving of the superficial catheter cuff. A control group of 138 patients implanted during the same time span as the study group was used for infection rate and survival comparisons.
Results: The salvage procedure cured the infection in all patients. No dialysate leaks occurred. Peritoneal dialysis was not interrupted. Surgical salvage provided successful long-term peritoneal dialysis that was equivalent to the cohort dialysis population.
Conclusion: Surgical salvage by unroofing/cuff shaving is an effective long-term solution for chronic exit-site and tunnel infection.

Keywords: Peritoneal dialysis; Peritoneal catheter; Catheter infections; Exit-site infections; Tunnel infections; Cuff shaving

Dialysis-related infections continue to be the primary cause for removal of the catheter and loss of peritoneal dialysis as a modality of renal replacement therapy. Chronic exit-site infections can lead to infection of the superficial catheter cuff in 2-cuff devices, tunnel tract infection, and catheter infection-related peritonitis as the infectious process progresses from the skin towards the peritoneum. Recommendations for treatment of chronic exit-site and tunnel infections that are not associated with concurrent peritonitis include catheter removal with simultaneous or delayed catheter replacement [1–3], replacement of the infected external tubing segment by catheter splicing [4–7], or unroofing of the tunnel tract and removal of the superficial catheter cuff [8–13]. The latter method is the least disruptive and least costly of the procedures; however, published results are unfavorable [14–16] or follow-up has been short [8–13]. Reported here is a catheter salvage technique for managing chronic exit-site and tunnel infection and long-term follow-up.

Materials and Methods

From October 1997 through May 2001, 151 consecutive patients underwent implantation of 2-cuff, coiled tip, peritoneal dialysis catheters using a laparoscopic approach previously described in detail [17]. Briefly, the peritoneal catheter was inserted through a paramedian port site through the rectus sheath and muscle while continuously monitoring the implant procedure with a laparoscope from a second port location. The deep catheter cuff was placed in the rectus muscle just below the anterior rectus sheath. Catheters with a swan neck shape were implanted so that the subcutaneous tunnel tract precisely followed the preformed tubing bend with the superficial cuff located 2–3 cm from the downwardly directed exit wound. Tenckhoff-style catheters were bent with an arc in the subcutaneous tissues so that the exit-site was directed laterally. During the time period of this report, the superficial cuff of Tenckhoff catheters was implanted 2–3 cm from the exit-site.

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0002-9610/05/$ – see front matter
doi:10.1016/j.amjsurg.2005.04.010

Between July 1999 and January 2002, 13 patients from the above-described patient group developed chronic exit-site and tunnel infection without concurrent peritonitis. These 13 patients underwent catheter salvage by unroofing the catheter tunnel and shaving of the superficial cuff. The remaining 138 patients served as a control group for infection rate and survival comparisons. All patient data in this report were recorded prospectively as part of a larger database maintained on the dialysis population at our institution.

Exit-site infections were diagnosed if signs of redness and purulent discharge were present [18]. Tunnel infection included induration or redness over the subcutaneous course of the catheter associated with tenderness and pain, with or without abscess formation [18]. Exit-site infection was considered a new event if the episode occurred more than 4 weeks after stopping antibiotic therapy or if the infection was caused by a different organism. Exit-site infections were considered chronic at the time of the second recurrence if the organism was the same and the patient had previously received a 2- to 4-week course of appropriate antibiotic therapy and intensified wound care.

All surgical salvage procedures were performed on an outpatient basis in the clinic or operating room under sterile conditions using local anesthesia. If patients were not currently on antibiotics, they were given a preoperative dose of an agent that covered the known infecting organism. Patients were instructed to drain the peritoneal cavity dry prior to the procedure.

The procedure consisted of making an elliptical incision around the exit-site (Fig. 1A). The incision was extended through the skin and subcutaneous tissues along the course of the catheter until the superficial cuff was identified (Fig. 1B). The cuff was mobilized from the tissues. The exit-site skin and all inflammatory tissue were completely excised to healthy tissue. Inspection was made to determine if the infection extended towards the deep cuff within the rectus sheath. A #15 scalpel blade applied parallel to the cuff surface was used to excise the cuff in repetitive slices until all of the cuff material was removed (Fig. 1C). The scalpel blade was changed frequently to assure ease in performing the shave without applying undue pressure on the tubing. The wound was irrigated with saline.

The catheter and the shaved tubing segment was directed out of the medial aspect of the incision and stabilized in this position by securing it to the adjacent skin surface with tincture of benzoin and sterile adhesive strips (Fig. 1D). In selected cases, in the absence of abscess or cellulitis, the redundant lateral portion of the wound was loosely approximated with absorbable sutures. The remainder of the wound was packed open with saline soaked gauze as a wet to dry application or dressed with silver sulfadiazine-impregnated gauze (Fig. 1E).

Postoperatively, the patients were permitted to resume peritoneal dialysis immediately. Oral antibiotic therapy was continued for 2 to 4 weeks after the surgery until healthy granulation tissue appeared. Patients were permitted to resume showering once the wound was covered with granulation tissue. Dressings were changed daily until the wound was completely healed, after which the patient resumed the routine exit-site protocol of daily antibacterial soap wash, hydrogen peroxide wipe, and a sterile gauze covering dressing (Fig. 1F).

Poisson regression analysis was used to compare exit-site infection rates between the surgical salvage group (study group) and the control group before and after the unroofing/cuff shaving procedure. Catheter survival free of loss from infection was estimated using the method of Kaplan and Meier. All causes for catheter loss except for infection were censored. Comparison of the survival curves for the study and control groups was performed with the log-rank test. All results were considered significant at $P < .05$.

Results

Thirteen patients on peritoneal dialysis an average of 28 ± 12.7 months (range 7.9–52.5 months) underwent surgical unroofing of the tunnel tract and cuff shaving for chronic exit-site and tunnel tract infection without signs of concurrent peritonitis. Infection was present for 3.2 ± 2.1 months (range .2–6.5 months) prior to the procedure. Infecting organisms are shown in Table 1.

No dialysate leaks occurred following the procedure. Peritoneal dialysis was resumed immediately. The procedure cured the infection in all patients. Wound healing was complete in 1.4 ± .4 months (range .9–2.2 months). Follow-up was 18.2 ± 11.6 months (range 6.6–42 months).

Two patients, known *Staphylococcus aureus* nasal carriers, underwent unroofing and cuff shaving for chronic exit-site and tunnel infection from this organism. Despite intranasal and exit-site mupirocin use, both patients developed new infections from *S aureus* involving the deep cuff 8.9 and 33.7 months after the surgical salvage procedure. One patient's deep cuff was not completely within the rectus sheath and partially extruded through the new exit-site. The second patient gained considerable weight causing the new exit-site to invaginate, thereby, making it difficult to clean. Both patients underwent successful insertion of a new catheter and removal of the old catheter at the same procedure.

Three catheters were lost 7.7, 8, and 12 months later from peritonitis without concurrent exit-site infection by an organism different from that producing the original chronic exit-site and tunnel infection. Four patients died from non-infectious causes 6.6, 7.3, 16.5, and 32 months later. Four patients continue on peritoneal dialysis 16.6, 17, 27.6, and 42 months following surgical salvage.

Before undergoing the surgical salvage procedure, the exit-site infection rate of the study group was significantly greater than the control group (Table 2). Following surgical unroofing of the tunnel tract and cuff shaving, the subse-