

*Brief Report***Outpatient CAPD catheter salvage for persistent exit-site/tunnel infection**Yves Clouâtre¹, Pierre Cartier¹, Robert Charbonneau¹, Clément Déziel¹, Michel Allard² and François Madore¹¹Service de Néphrologie and ²Service de chirurgie, Hôpital du Sacré-Cœur de Montréal, Université de Montréal, Québec, Canada**Abstract**

Background. Partial replantation (i.e. replacement of the extraperitoneal portion of the catheter with creation of a new subcutaneous tunnel) has been suggested to avoid catheter removal in patients with persistent exit-site/tunnel infection (ESTI). However, published experience with this technique is limited.

Methods. Partial replantation was performed on an outpatient basis under local anesthesia for seven patients with persistent ESTI of >3 months duration. All patients resumed CAPD immediately following surgery.

Results. One patient had dialysate leakage less than 1 week after surgery that required catheter removal. The other patients had no complications and mean catheter survival following surgery was 7.7 months (range 3.5–13 months). There was no recurrence of ESTI after surgery, although two patients presented with exit-site infection unrelated to the initial episode (i.e. different organism, long latency). Three other patients presented with episodes of peritonitis unrelated to surgery (i.e. delay >1 month) or ESTI (i.e. different organism).

Conclusions. Partial replantation allows significant prolongation of catheter survival without major complications or interruption of CAPD. This novel procedure appears to be an appropriate alternative to catheter removal for the management of persistent ESTI. However, further studies are needed to prospectively compare partial replantation with catheter removal.

Key words: catheter salvage; continuous ambulatory peritoneal dialysis; exit-site/tunnel infection; outpatient procedure

chronic ambulatory peritoneal dialysis (CAPD) [1,2]. Inappropriate treatment of ESTI may lead to refractory or recurrent peritonitis, cuff infections, and extensive cellulitis of the abdominal wall [3]. In addition, a significant proportion of ESTI are unresponsive to treatment or require prolonged courses of antibiotics [1–3]. Catheter removal with or without simultaneous reinsertion of a new catheter is frequently required in cases of unresponsive ESTI [3,4]. Data from the National CAPD Registry indicate that up to 39% of catheter removals are related to persistent ESTI unresponsive to antibiotic therapy [5]. Moreover, intractable ESTI are a major cause of catheter-related complications that are responsible for up to 20% of all permanent transfers from CAPD to haemodialysis [1,2].

Catheter removal with or without reinsertion of a new catheter may be associated with complications such as dialysate leakage and intraperitoneal bleeding. In addition, this procedure usually implies interruption of CAPD and temporary transfer to haemodialysis with the requirement for vascular access.

We report an outpatient technical procedure that avoids catheter removal for persistent ESTI in CAPD patients. The procedure, partial catheter replantation, consists of the replacement of the sole extraperitoneal portion of the catheter with the creation of a new subcutaneous tunnel. Experience with partial replantation is limited. Only one case series has been published to date with encouraging results [6].

The goal of the present study was to evaluate the efficacy of partial catheter replantation for the treatment of refractory ESTI.

Methods*Patients*

We reviewed the medical records of all patients who underwent partial catheter replantation at our institution since 1997. All patients had the same operative technique and all procedures were performed by the same surgeon. Table 1 summarizes the patients' characteristics. Seven patients were included, and the mean age was 64.5 years (range 56–75

Introduction

Exit-site/tunnel infections (ESTI) remain frequent and associated with significant morbidity in patients on

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Table 1. Patient characteristics

Patient	Age (years)	Cause of ESRD	Time on CAPD (months)	ESTI duration (months)	Type of germ
1	68	Hypertension	49	48	<i>S. aureus</i> ^a
2	64	Diabetes	24	8	Multigerms ^b
3	56	Hereditary nephritis	39	23	<i>S. aureus</i>
4	61	Glomerulonephritis	5	3	<i>S. aureus</i>
5	64	Diabetes	19	7	<i>S. aureus</i>
6	75	Ischaemic nephropathy	66	10	<i>P. aeruginosa</i> ^c
7	64	Diabetes	32	12	<i>S. aureus</i>

^a*Staphylococcus aureus*.

^b*Pseudomonas aeruginosa* and *Staphylococcus epidermidis*.

^c*Pseudomonas aeruginosa*.

years). At the time of surgery, patients had been on CAPD for an average of 33 months (range 5–66 months). All patients had Cruz catheter (Corpak MedSystems, Wheeling, IL, US). Informed consent was obtained for all patients. Persistent ESTI was defined as purulent drainage with positive culture despite appropriate antibiotic therapy. Persistent ESTI was present in all patients for >3 months (mean 16 months). Different pathogens were incriminated in the infections, mainly *Staphylococcus aureus*, but also *Pseudomonas aeruginosa*.

Surgical technique

Partial replantation of the catheter was performed under local anesthesia with 1% lidocaine on an outpatient basis. The procedure involves the replacement of the sole extraperitoneal part of the CAPD catheter, leaving the intraperitoneal part untouched with its inner cuff as well as a short segment of the extraperitoneal portion. As shown in Figure 1A and B, the outer cuff of the catheter is dissected and a longitudinal incision is performed along the catheter tunnel to mobilize the extraperitoneal segment of the catheter. The catheter is divided leaving a short (1 cm) segment in place (catheter stump). A new extraperitoneal segment consisting of an amputated new double-cuff catheter is connected to the resting part of the old catheter after careful reesterilization of the old tunnel. To connect the two catheters, an endoluminal

connector is used (Corpak MedSystems, Wheeling, IL, US). This type of connection alleviates the use of silicone glue or other adhesive material. A new subcutaneous tunnel is then created, leaving the old tunnel opened for second intention healing (Figure 1C and D). Finally, a saline irrigation is performed to verify catheter permeability.

Results

All procedures were performed on an outpatient basis and CAPD was resumed immediately postoperatively for all patients. No immediate complications occurred. One patient had dialysate leakage less than 1 week after surgery due to defective connection, and required catheter removal. The other patients had no complications and catheter survival following surgery ranged from 3.5 to 13 months (mean 7.7 months). Table 2 describes catheter outcome following partial replantation. Antibiotics were not systematically administered postoperatively and all infected exit-sites and tunnels healed rapidly within a few weeks. There was no recurrence of ESTI following surgery after a total of 47 patient-months of follow-up although two patients presented with ESTI unrelated to the initial episode (i.e. different organism, long latency). One patient presented with ESTI > 1 month postoperatively with a different germ than the initial ESTI (*Proteus mirabilis* versus *S. aureus*). The second patient was initially cured from *S. aureus* ESTI following surgery, but 7 months later presented with another exit-site infection. The infective germ was again *S. aureus* but the long latency between the two episodes supported a re-infection rather than a recurrence. Three other patients presented with episodes of peritonitis unrelated to surgery (i.e. delay > 1 month) or ESTI (i.e. different pathogens).

Discussion

While few strict guidelines are available for treatment of ESTI, a recent report from the International Society for Peritoneal Dialysis advises absolute catheter replacement when the inner cuff of the catheter is infected [7]. In other conditions, such as refractory or

Table 2. Catheter outcome

Patient	Catheter outcome	Catheter survival ^a (months)
1	Functioning catheter (same catheter)	13
2	Catheter removed due to peritonitis (different germ ^a)	7
3	Catheter removed due to early leakage	0.5
4	Catheter removed due to peritonitis (unknown germ)	7
5	Catheter removed due to transplantation	9
6	Catheter removed due to peritonitis (different germ ^b)	7
7	Functioning catheter (same catheter)	3.5

^aCatheter survival following partial replantation.

^bDifferent germ than initial ESTI.

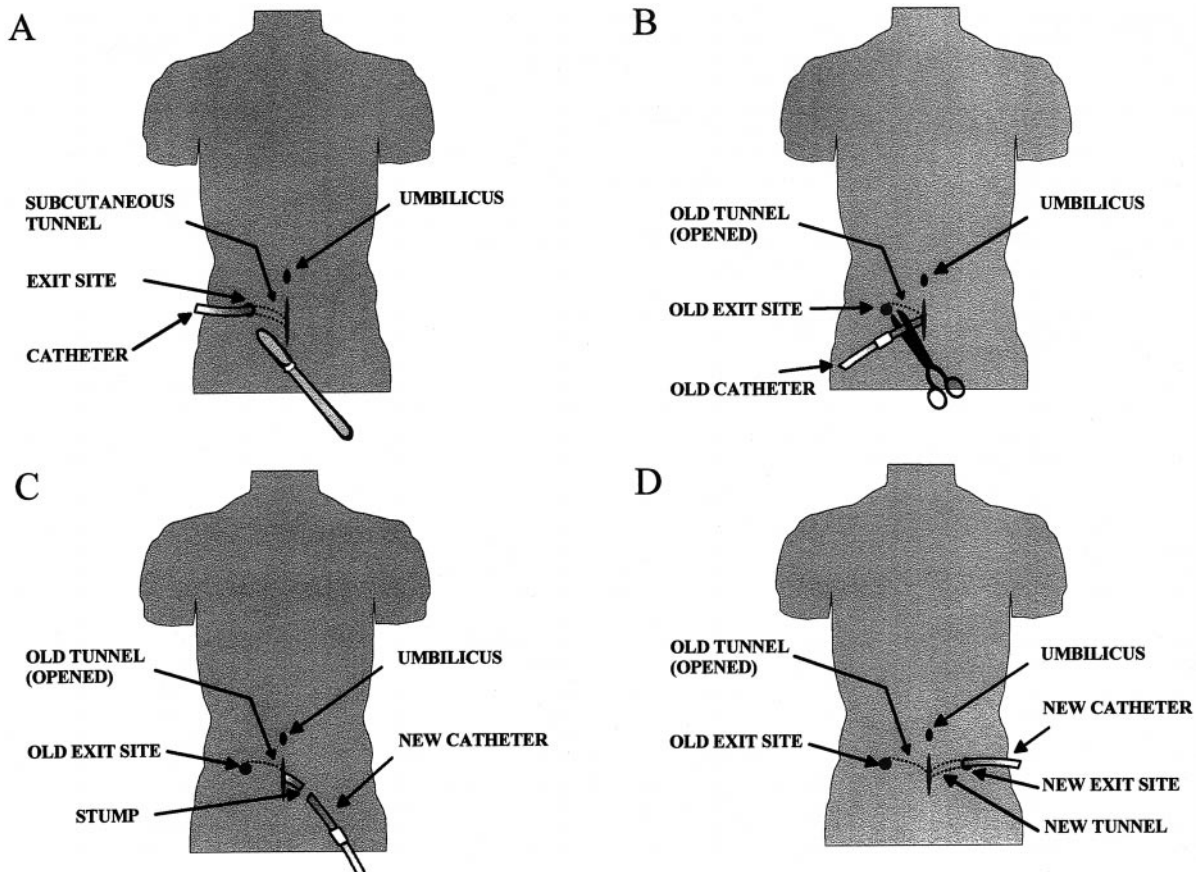


Fig. 1. Partial replantation surgical technique. (A) The outer cuff of the catheter is dissected and a longitudinal incision is performed along the subcutaneous tunnel. (B) The external portion of the catheter is mobilized and the catheter is divided to leave the proximal portion of the catheter in place (catheter stump 1 cm). (C) A new extraperitoneal segment is connected to the catheter stump. (D) A new subcutaneous tunnel is created leaving the old tunnel opened for second intention healing.

recurrent peritonitis associated with ESTI or extensive cellulitis unresponsive to antibiotics, the same report recommends that catheter removal should be considered [7]. However, no specific guideline is provided as to the best timing. In addition, catheter removal implies the interruption of CAPD added to the possibility of dialysate leakage and intraperitoneal bleeding associated with the insertion of a new catheter.

Partial catheter replantation has been suggested to alleviate ESTI while avoiding the complications associated with catheter removal [6]. The rationale for this technique is the removal of the foreign body (i.e. the catheter) that prevents complete eradication of infective pathogens. The catheter and its external cuff, once infected by pathogens, provide a source for persistent colonization. The removal of the catheter eliminates this source of colonization and therefore facilitates the eradication of infective pathogens. However, the replacement of the entire catheter is not essential. Removal of the sole external portion of the catheter is sufficient to obtain similar results in terms of infection control when the inner cuff of the catheter is not involved in the infection.

The present study was carried out to document the efficacy of partial catheter replantation for treatment

of ESTI. Our experience is consistent with previous data published in the literature. In a study by Chao *et al.* six patients underwent partial replantation of Tenckhoff catheters [6]. There were no initial complications, all of the infected exit-sites and tunnels healed in 2–3 weeks, and no recurrences of ESTI or other catheter-related complications were detected during a total of 37 patient-months of follow-up [6]. Our technique is similar in many aspects to the one described by Chao *et al.* [6]. However, there are a number of differences. First, all of our procedures were performed on an outpatient basis. In contrast, all patients were hospitalized for up to 24 days in Chao's series [6]. Second, our protocol does not include systematic administration of antibiotics postoperatively. However, in the study by Chao *et al.* antibiotics were administered for 10–14 days in all patients [6]. Third, our surgical technique does not require the use of adhesive material whereas silicone glue was used for all patients in Chao's group [6]. The use of adhesive material may be problematic because some types of catheters have a chemical composition that does not allow the use of any adhesive material. In addition, this technique can be applied to different types of catheter design and configuration (i.e. straight, curved,

etc.). Thus, our technique may be used with any type of peritoneal catheter.

There are several advantages to partial catheter replantation over catheter removal. First, partial replantation may be performed on an outpatient basis under local anesthesia. Complete removal and installation of a new catheter usually requires general anaesthesia and hospitalization. Second, partial replantation avoids interruption of CAPD and the need for a temporary transfer to haemodialysis. In all patients, resumption of CAPD is possible immediately post-operatively, following partial replantation. Third, since the intraperitoneal portion is left untouched, complications such as intraperitoneal bleeding, dialysate leakage and catheter malposition are avoided with partial replantation.

However, there are some limitations to partial catheter replantation. First, infections involving the catheter inner cuff cannot be treated with partial replantation. Such infections are absolute indications for complete catheter removal [7]. Second, partial replantation is impossible in patients who have already undergone this procedure.

Our actual approach to refractory ESTI is the following. Appropriate antibiotic therapy is given for several weeks. Adjunct therapies, such as cauterization, soaking solutions and cuff shaving are attempted if indicated. If no improvement occurs and infection does not involve the inner cuff, partial replantation is performed. If the inner cuff is infected, complete removal of the catheter is required.

In summary, partial catheter replantation allows significant prolongation of catheter survival without major complications, interruption of CAPD, or recur-

rence of ESTI. This novel procedure appears as an appropriate alternative to catheter removal for the management of persistent ESTI. However, further studies are needed to prospectively compare partial replantation with catheter replacement and other therapeutic strategies for ESTI.

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