A Novel Technique for Repositioning, Under Local Anesthetic, Malfunctioning and Migrated Peritoneal Dialysis Catheters

In patients treated with peritoneal dialysis (PD), catheter-related complications are important causes of morbidity and technique failure (1). Catheter malfunction evident as reduced outflow of dialysate has been reported to be 5% – 35% (2) and is commonly caused by constipation, catheter migration outside the pelvis, or omental wrapping. For patients with outflow obstruction, current guidelines suggest using conservative measures first, and then, if those measures fail and the catheter has migrated, a repositioning attempt. A variety of approaches for reposition have been described: peritoneoscopy, fluoroscopy-guided techniques (2–4), laparoscopy (5), and conventional surgery. Peritoneoscopy and fluoroscopy-guided methods are feasible for nephrologists and are minimally invasive.

In our department, a novel technique for repositioning PD catheters inserted under local anaesthetic has been developed and used since November 2008. The objectives of the present study were to describe the technique and to examine its efficacy and complications.

METHODS

Our department of Renal Medicine at King's College Hospital has a PD program of approximately 100 prevalent patients (including about 40 new patients annually). In the program, after a detailed evaluation of the patient, about 85% of catheters are inserted under local

anesthetic by nephrologists or trained PD specialist nurses. Any malfunctioning catheters inserted under local anesthetic are repositioned using a novel technique. For the present study, we conducted a retrospective cohort analysis of all repositions performed using that technique over a period of 3 years (November 2008 to November 2011).

All data were collected from the departmental electronic clinical database, in which relevant information is routinely recorded in real time and in sufficient detail. We captured data on demographics; time of catheter insertion and PD initiation; and cause and type of obstruction, concomitant symptoms, and catheter position at the time of obstruction. Outcomes relevant to repositioning were successful catheter function immediately after the procedure, on the first day of use, and at 1 week, 1 month, and 12 months after PD start. Other recorded outcomes were relevant to catheter failure, PD failure, procedure-related complications, and hospital admissions. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS, Chicago, IL, USA).

Reposition Procedure: Catheters inserted in our PD center are coiled two-cuff Tenckhoff catheters. Insertions, which are considered day-cases, are performed under local anesthetic in a dedicated PD procedure room by experienced operators using the modified Seldinger technique and a short transverse subumbilical incision. The internal Dacron cuff is placed within the subcutaneous fat of the anterior abdominal wall. The catheter is tunneled to exit in a caudal direction, with the external cuff lying subcutaneously near the exit site.

Before reposition is attempted, malfunctioning catheters are managed with catheter flush attempts and, for patients with clinical or radiographic evidence of constipation, with additional prescription of a bowel-cleansing product (Picolax: Ferring Laboratories, Saint-Prex, Switzerland) on top of permanent laxative treatment (senna and sodium docusate). Repositioning is performed in the PD procedure room under cardiorespiratory monitoring. Patients are not premedicated with analgesics or sedatives, with the exception of the very occasional patient requesting sedation. All manipulations are performed using strict aseptic techniques. The abdominal wall surface is prepared with chlorhexidine solution and isolated with sterile drapes. Antibacterial prophylaxis with a single dose of intravenous vancomycin (1 g) is given 1 hour before manipulation.

With the patient in supine position, the internal cuff is palpated, and a small amount of local anesthetic (lidocaine HCl 2% with epinephrine 1:100,000) is infiltrated

in the subumbilical position, near the internal cuff, with particular care taken not to puncture the catheter. A skin incision is made through the original scar, and the PD catheter is exposed [Figure 1(A)]. The internal cuff is released with blunt dissection so that the catheter can be withdrawn from the peritoneal cavity. The catheter is slowly pulled from the abdominal cavity until the first side holes of the catheter are visible. At that point, a standard flexible guidewire is inserted through a proximal side hole and gently pushed through the central lumen toward the tip of the catheter [Figure 1(B)]. The catheter is then gently withdrawn, and the wire is simultaneously pushed through the catheter into the abdominal cavity. When the catheter is at a point where the wire is visible between the abdominal wall and the catheter tip, the operator holds the guidewire in place and pulls the rest of the catheter out over the wire [Figure 1(C)].

With the guidewire in the abdominal cavity, the subsequent steps are similar to those for introducing a new catheter under local anesthetic. A standard dilator is passed over the guidewire through the abdominal wall [Figure 1(D)], and then a dilator with covering sheath is inserted and directed toward the pelvis. When the sheath is in place, the guidewire and dilator are removed [Figure 1(E)]. The catheter is inserted through the sheath into the abdominal cavity and directed toward the pelvis. After that, the sheath is split and removed, and the final part of the catheter is pushed into the peritoneal cavity [Figure 1(F)]. The internal cuff is reburied in the subcutaneous fat. Catheter patency is tested by flushing; suturing of the skin incision concludes the procedure.

RESULTS

We identified 24 repositions in 22 patients (22 initial and 2 repeat repositions). Of the 22 patients, 17 were followed in the Low-Clearance Clinic and 5 presented acutely with renal failure requiring dialysis. However, PD started according to protocol in only 14 patients; in 8 patients (including the 5 with acute renal failure), PD started within 1 week of catheter insertion. Importantly, 2 catheters required repositioning before the start of PD. Table 1 includes information relevant to catheter malfunction. One patient had no flow obstruction, but only abdominal pain and catheter migration.

Table 2 shows that immediate success of the reposition was noted in 21 of the 22 patients (95.5%). For the patient with the immediately malfunctioning catheter (partial outflow obstruction), the cause was

unknown (radiography showed the catheter within the pelvis and no constipation). A repeat reposition was attempted the following day, again without success; the patient refused further interventions and opted for conservative treatment.

Start of PD was attempted after 3.4 ± 7.0 days (range: 0 – 30 days) and was successful in 20 patients. At 1 month after PD start, the catheter was functioning in 16 patients. The cause of catheter failure was migration coupled with constipation for all patients, with the exception of 1 patient who had wound infection involving the proximal cuff, which led to catheter removal 8 days after the procedure. Catheter failure at between 1 month and 3 months of follow-up occurred in 2 patients, and beyond 12 months in another 2 patients (all as a result of migration or constipation). Among the 10 patients with catheter malfunction during follow-up, 6 were transferred to hemodialysis, 1 opted for conservative treatment, 1 underwent a successful repeat reposition, and 2 patients received new catheters. Failure of PD was noted in 10 of the 22 patients; of those 10 patients, 5 experienced simple catheter malfunction. Immediate complications were not noted in any patient. Table 2 shows other procedure-related complications and hospital admissions.

DISCUSSION

Peritoneoscopy or modified Seldinger insertion of PD catheters by nephrologists is performed throughout the world with success comparable to that for surgical techniques. Performing catheter-related procedures through an interventional nephrology program is a major factor in increasing the use of PD among patients with end-stage renal disease (6). Several nonsurgical approaches for the correction of malfunctioning PD catheters have evolved: examples include peritoneoscopy and fluoroscopy-guided techniques with stiff guidewire (3), flexible guidewire (4), Fogarty catheter (2), or double guidewire (7). Fluoroscopy-assisted repositioning has had immediate success in 80% – 90% of patients and long-term success (usually reported as 1 month of patency after insertion) in 25% – 75% of patients (2–5,7). Techniques using “alpha-replacers” (8) or a Malecot introducer (9), proposed as alternatives for malfunctioning swan-neck catheters, had immediate and 1-month success rates of 90% and 54% – 71% respectively. Immediate and long-term patency of 90% – 97% and 54% – 62% were reported with laparoscopic techniques (5,10), which can also correct adhesions or omental wrapping, but which require general anesthesia and have a higher risk of complications.

Figure 1 — Peritoneal dialysis (PD) catheter repositioning under local anesthetic. (A) Exposing the PD catheter. (B) Inserting the guidewire. (C) Pulling the catheter out of the peritoneal cavity over the guidewire. (D) Passing a dilator, with covering sheath, over the guidewire. (E) The sheath in place after the guidewire and dilator are removed. (F) Pushing the catheter into the peritoneal cavity after the sheath is split and removed.

TABLE 1

Patient Demographics and Characteristics Relevant to Peritoneal Dialysis (PD) and Catheter Malfunction

Variable	Value
Mean age (years)	56.2±19.1
Sex [<i>n</i> (%)]	
Men	17 (77.3)
Women	5 (22.7)
PD start [<i>n</i> (%)]	
Planned	14 (63.6)
Acute (<1 week from insertion)	8 (36.4)
Time from catheter insertion to malfunction (days)	78.6±145.8
PD modality at malfunction [<i>n</i> (%)]	
Continuous ambulatory PD	3 (13.6)
Automated PD	19 (86.4)
Malfunction cause [<i>n</i> (%)]	
Migration and constipation	12 (54.5)
Migration	5 (22.7)
Constipation	1 (4.5)
Constipation and kinking	1 (4.5)
Unknown	3 (13.6)
Obstruction [<i>n</i> (%)]	
Inflow partial	5 (22.7)
Inflow complete	0
Outflow partial	18 (81.8)
Outflow complete	3 (13.6)
Migration without obstruction	1 (4.5)
Pain [<i>n</i> (%)]	7 (31.8)
Catheter tip position [<i>n</i> (%)]	
Right upper quadrant	8 (36.4)
Left upper quadrant	1 (4.5)
Epigastrium	2 (9.1)
Midline/adjacent to L3-L4	4 (18.2)
Over right flank	1 (4.5)
Over left flank	1 (4.5)
Within the pelvis	5 (22.7)

PD = peritoneal dialysis. Continuous variables are presented as mean±SD

The immediate success rate for our method was 95.5%; success at PD start was 90.9%, and for 1-month patency, it was 72.7%. The rate of complications was low, and most of the complications were easy to deal with. Only 1 patient had a catheter removed because of a procedure-related complication. Our method has all the advantages of the fluoroscopic techniques; it is simple and minimally invasive, it can be performed on an outpatient basis, and it allows for quick catheter use. Moreover, it avoids the need for radiologic guidance. Thus, it can be a useful alternative repositioning technique for migrated Tenckhoff catheters inserted under local anesthetic.

TABLE 2

Outcomes and Complications of the Repositioning Procedure

Variable	Value
Mean time to repositioning (days)	
From catheter insertion	87.5±145.8
From PD start with this catheter ^a	80.7±141.6
Successful catheter function after repositioning [<i>n</i> (%)]	
Immediate	21 (95.5)
At PD start	20 (90.9)
1 Week after PD start	18 (81.8)
1 Month after PD start	16 (72.7)
Catheter failure during follow-up [<i>n</i> (%)]	10 (45.5)
PD failure during follow-up [<i>n</i> (%)]	10 (45.5)
Cause of PD failure [<i>n</i> (%)]	
Catheter malfunction	5 (22.7)
Abdominal wound infection	1 (4.5)
Abdominal hernia	1 (4.5)
Ultrafiltration loss	1 (4.5)
Exit-site infection	1 (4.5)
Poor compliance with PD regime	1 (4.5)
Procedure-related complications [<i>n</i> (%)]	
Blood-stained dialysate	1 (4.5)
PD fluid leak	1 (4.5)
Abdominal pain	1 (4.5)
Peritonitis	1 (4.5)
Wound infection	1 (4.5)
Reason for hospital admission after procedure [<i>n</i> (%)]	
PD fluid leak	1 (4.5)
Pain or malfunction	1 (4.5)
Constipation or malfunction	1 (4.5)
Wound infection	1 (4.5)

PD = peritoneal dialysis.

^a For 20 patients that had started PD.

DISCLOSURES

The authors declare that no financial conflict of interest exists regarding this article.

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