

A Series of Unusual Complications of the Presternal Peritoneal Dialysis Catheter

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An ongoing problem for peritoneal dialysis (PD) patients has been complications associated with an indwelling PD catheter. The indwelling catheter has been through many modifications aimed at reducing complications and providing effective delivery of dialysis solution. In this report, we review four cases of rare complications associated with presteral PD catheters and a brief review of the Tenckhoff, Toronto Western Hospital, and Missouri swan-neck abdominal and presteral PD catheters.

Key words

Missouri swan neck, presteral, catheter, complications

Introduction

Continuous ambulatory peritoneal dialysis (CAPD) is an efficient and convenient modality for many individuals with end-stage renal disease (ESRD). However, the technique is not without complications. Complications can affect patient comfort and compliance and, ultimately, technique survival. A primary source of complications for these patients is the indwelling dialysis catheter.

Catheter complications are divided into two main categories: infectious and noninfectious. Infectious complications can occur at the catheter exit site, in the catheter tunnel or the peritoneum, or in the catheter itself (formation of a biofilm). Common noninfectious complications include outflow failure, dialysis solution leaks (either pericatheter or through weak spots in the peritoneal cavity), abdominal hernias, catheter cuff extrusion, and perforation of a viscus.

Since the introduction of CAPD in 1976, peritoneal catheter design has undergone many advances. These advances have reduced overall discomfort, improved efficiency, and decreased peritonitis rates, catheter-related infections, and mechanical dysfunctions. The Tenckhoff catheter, first described in 1968 (1), has been the basis of most major catheter innovations. Subsequently, the Toronto Western Hospital (TWH) catheter, described in 1976 (2), incorporated modifications to the Tenckhoff catheter primarily to reduce pericatheter leak of dialysis solution and to prevent catheter tip migration out of the pelvis.

Our institution introduced modifications to the Tenckhoff catheter with the Missouri swan-neck abdominal and presteral peritoneal dialysis (PD) catheters in 1991 (3). Data supports patient preference for the presteral catheter type as compared with the abdominal type because of better body image, convenience of use, and ability to sit in a bathtub (4). The presteral location is particularly useful in obese patients with a pendulous abdominal wall (body mass index above 35), in patients with ostomies or diapers, and in patients with urinary or fecal incontinence.

Although the presteral catheter has reduced the occurrence of infectious and noninfectious complications, we have observed a unique set of problems with it. In this report, we review several cases of unusual presteral PD catheter complications.

Case reports

Fractured peritoneal catheter masquerading as a hernia

A 41-year-old paraplegic white man with ESRD secondary to acquired obstructive uropathy was managed on CAPD for 1 year. He presented to the PD clinic with a 1-week history of a new painless swelling near the left supraumbilical region and inability to drain dialysate when seated in an upright position. The

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swelling was close to the site of a previous catheter-related incision. Physical exam revealed a painless and reducible 5 × 5-cm swelling. The patient underwent elective hernia repair and was found to have a pocket of dialysis solution at a fracture in the catheter just below the titanium connector. The catheter did not require replacement; instead, it was repaired, and the patient experienced no further complications.

We postulate the reason for this catheter fracture was undue repeated catheter stress at the end of the titanium connector because of the unusual posture adopted by this paraplegic individual.

Chronic infection of titanium connector presenting as recurrent peritonitis

A 62-year-old man on CAPD with a 3-year-old presteral catheter presented with a chief complaint of cloudy peritoneal fluid. Peritoneal fluid analysis confirmed peritonitis, and culture grew *Acinetobacter baumannii*. He was treated with 2 weeks of intraperitoneal cefazolin and tobramycin, and symptoms resolved. Later that same month, the patient returned with a chief complaint of nausea, cramping, and dark peritoneal fluid. A cultured sample of peritoneal fluid again confirmed peritonitis and grew cefazolin-resistant *A. baumannii*. The subcutaneous tunneled portion of the presteral catheter was replaced, and symptoms resolved after intraperitoneal tobramycin therapy.

One month later, the patient returned with a chief complaint of cloudy peritoneal fluid and diarrhea. Peritoneal fluid analysis revealed an elevated white blood cell count consistent with peritonitis, but cultures were negative. The patient's symptoms improved on empiric intraperitoneal tobramycin and oral levofloxacin. He remained healthy for approximately 3 months, when he reported to the clinic with nausea, emesis, diarrhea, and cloudy peritoneal fluid. Again, peritoneal fluid analysis revealed peritonitis with elevated white blood cell count and negative cultures. Patient's symptoms resolved with empiric intraperitoneal cefazolin and tobramycin, and oral levofloxacin.

This patient remained healthy for approximately 1 month, at which time he returned with recurrent peritonitis and cultures positive for *A. baumannii*. The upper segment of the catheter and the titanium connector were replaced and culture of the titanium connector proved positive for *A. baumannii* (Figure 1). The patient has since remained on CAPD without complications.

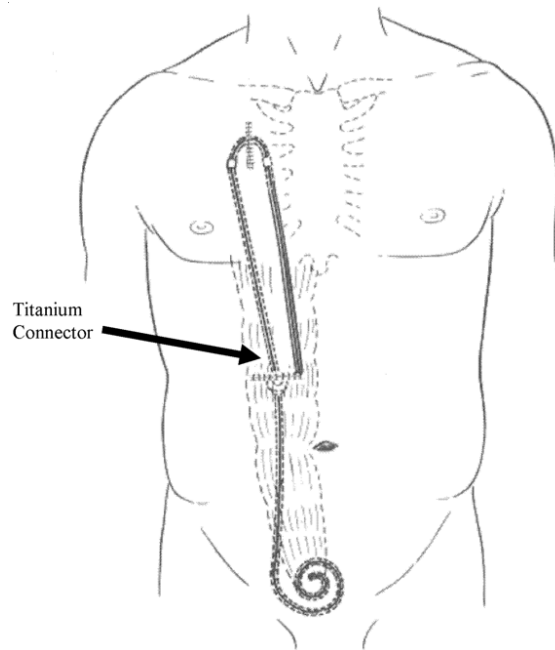


FIGURE 1 Arrow shows the location of the infected titanium connector connecting the upper portion of the presteral catheter to the lower portion.

Dialysis solution leak between exit site and the first cuff

A 47-year-old man with ESRD secondary to HIV nephropathy and hypertension, previously on chronic hemodialysis for 5 years, was seen in the PD clinic for PD training. He was transferred to PD secondary to four failed arteriovenous fistulae and loss of multiple internal jugular catheters. A presteral PD catheter was placed in preparation for transfer to PD 1 month later.

During dialysis training, this patient reported wet dressings while PD solution was in the peritoneal cavity; however, evaluation by peritoneal nurses revealed no obvious dialysis solution leaking from the exit site. A contrast computed tomography (CT) scan of the catheter was obtained in an attempt to identify the source of the leak. The CT revealed a small fluid collection between the exit site and the first cuff (Figure 2). The presteral portion of the catheter was removed and replaced. In the excised portion of the catheter, a pinhole was noted near the exit site. Injection with colored water while the distal end of the catheter was clamped showed that fluid readily passed through the pinhole

opening (Figure 3). After the presteral portion of the catheter was replaced, the leak resolved. The patient resumed PD immediately without further complications.

We postulate a probable iatrogenic cause for the leak: a needle puncture from injection of local anesthetic during closure of the wound or a manufacturing defect.

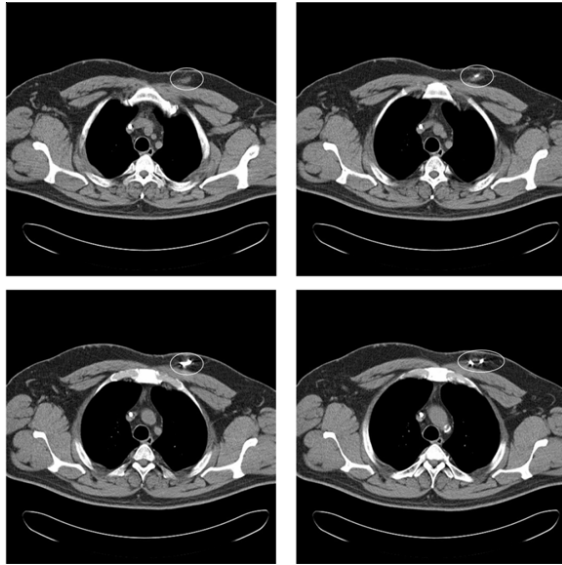


FIGURE 2 Computed tomographic exam with contrast injected into the presteral peritoneal dialysis catheter reveals extravasation of contrast into the subcutaneous tissue near the exit site.



FIGURE 3 Yellow fluid leaking from the presteral dialysis catheter near the exit site.

Dialysis solution leak close to exit site

A 39-year-old woman with ESRD who had been on hemodialysis for 4 months secondary to diabetes mellitus elected to switch to PD for convenience. She had a presteral PD catheter placed approximately 1 month before presenting for PD training. On her first dialysate fill during training, clear fluid was seen leaking from the catheter exit site. A glucose dipstick turned strongly positive on exposure to the clear fluid, confirming the suspicion that the leak was dialysate. The patient was taken back to the operating room, where the superior portion of the catheter was exchanged. No further leaks were seen. A small hole in the catheter near the titanium connector at the subcutaneous peritoneal exit site was demonstrated (Figure 4).

Discussion

In this report, we presented a series of rare mechanical complications of the presteral PD catheter, uncommon to other catheter types. These complications were the result of catheter material defect or had iatrogenic causes related to technique error or manufacturing defect. In none of the complications did the entire catheter have to be replaced (a common management strategy for complications of catheter types).

A commonly used PD catheter, the Tenckhoff catheter, is a modification of a previous catheter (5). It was the most successful of the early PD catheters and is

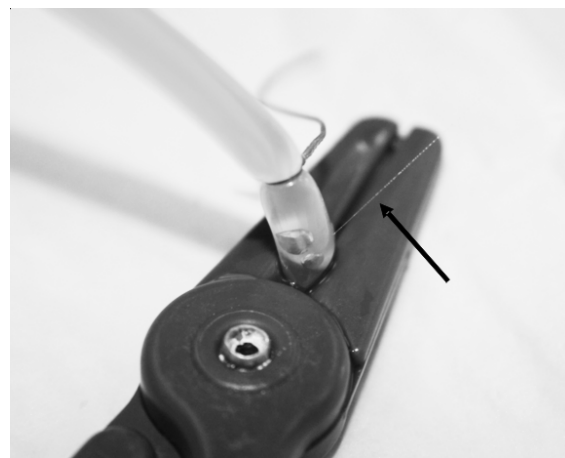


FIGURE 4 A small stream of yellow dye (arrow) is seen leaking from this presteral catheter near the connection to the titanium connector.

still currently in use in some centers (1). The catheter incorporates a flexible and relatively inert catheter tubing made of silicone to reduce catheter trauma and tissue reaction. A polyester cuff replaced the intra-abdominal flange, and a second, external cuff was added. These cuffs serve to reduce periluminal migration of bacteria and to encourage tissue ingrowth, fixing the catheter in place. Additionally, the size of the side holes in the intraperitoneal segment were optimized to 0.5 mm to reduce tissue incarceration and obstruction, and the subcutaneous segment was shortened, with the external exit site pointing downward.

The Tenckhoff catheter has undergone many modifications since its release. The TWH catheter, another commonly used permanent PD catheter, is a modification of the Tenckhoff catheter. The Missouri swan-neck design and the presternal PD catheter, also variations of the Tenckhoff, have recently been gaining in popularity.

The TWH catheter was designed by Oreopoulos and Zellerman (2). The TWH catheter is similar to the Tenckhoff catheter, with three notable additions. First, the distal intra-abdominal segment includes two flat discs designed to prevent omental wrapping and to maintain the catheter low in the pelvis. Second, a silicone bead just inside the peritoneum aids in preventing leakage. Third, a felt disc just outside the peritoneum is sutured to the rectus muscle to reduce catheter movement and assist in tissue ingrowth and fixation.

The Missouri swan-neck catheter features a molded bend between the two subcutaneous cuffs. This design places the internal and external exits of the catheter in an unstressed, downward position. The downward positions help to reduce exit-site and tunnel infections, peritonitis rates, cuff extrusions, and intraperitoneal tip migration. Swan-neck catheters are available in three basic designs: Tenckhoff, TWH, and presternal.

Our institution exclusively uses the presternal PD catheter. This catheter incorporates an intraperitoneal flange and bead that serve to minimize dialysate leaks, and two polyester subcutaneous cuffs near the exit site, which minimize catheter movement and restrict periluminal migration of bacteria. Additionally, the catheter is tunneled in the subcutaneous tissue from the intraperitoneal exit to a parasternal exit site. This longer track serves to further minimize

peritoneal infections and to reduce the likelihood of pericatheter fluid leaks.

Detailed reviews of peritoneal catheters and presternal peritoneal catheters are available (6,7).

Conclusions

In each of the rare and unusual complications related to the presternal PD catheter that were presented in this report, the catheter was salvaged without replacement of the intraperitoneal segment. With the exceptions of a more complicated insertion technique and slower dialysis solution flow, the swan-neck presternal catheter is generally accepted as having very few disadvantages and being preferred by many patients (4).

Acknowledgment

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References

- 1 Tenckhoff H, Schechter H. A bacteriologically safe peritoneal access device. *Trans Am Soc Artif Intern Organs* 1968;14:181-7.
- 2 Oreopoulos DG, Izatt S, Zellerman G, Karanicolas S, Matthews RE. A prospective study of the effectiveness of three permanent peritoneal catheters. *Proc Clin Dial Transplant Forum* 1976;6:96-100.
- 3 Twardowski ZJ, Nichols WK, Nolph KD, Khanna R. Swan-neck presternal ("bath tub") catheter for peritoneal dialysis. *Adv Perit Dial* 1992;8:316-24.
- 4 Twardowski ZJ. Presternal peritoneal catheter. *Adv Ren Replace Ther* 2002;9:125-32.
- 5 Palmer RA, Quinton WE, Gray JE. Prolonged peritoneal dialysis for chronic renal failure. *Lancet* 1964;1:700-2.
- 6 Twardowski ZJ, Nichols WK. Peritoneal dialysis access and exit-site care including surgical aspects. In: Gokal R, Khanna R, Krediet RT, Nolph KD, eds. *Textbook of peritoneal dialysis*. 2nd ed. Amsterdam: Kluwer Academic Publishers; 2000: 307-61.
- 7 Khanna R, Twardowski ZJ. Peritoneal dialysis access. In: Nolph KD, ed. *Peritoneal dialysis*. 3rd ed. Amsterdam: Kluwer Academic Publishers; 1989: 319-42.

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