

## Laparoscopic management of malfunctioning peritoneal dialysis catheters

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### Abstract

**Background:** Continuous ambulatory peritoneal dialysis (CAPD) is an established alternative method to hemodialysis for treating end-stage renal disease patients. However, this method is associated with a significant number of complications, such as catheter malposition, omental wrapping, and infection. The purpose of this study was to determine the efficacy of laparoscopy in the treatment of malfunctioning CAPD catheters.

**Methods:** Between November 1994 and June 1999, a total of 16 patients with CAPD underwent laparoscopy for the evaluation and management of CAPD catheter dysfunction. Two trocars (10-mm and 5-mm) were used. Recorded data included patient demographics, catheter implantation method, date of malfunction, cause of dysfunction, procedure performed, complications, and catheter outcome.

**Results:** The primary etiology of dysfunction was omentum and/or small bowel wrapping with adhesions in eight cases, malpositioning in five cases, and infection in the remaining three cases. Adhesiolysis was performed in the eight cases with adhesions. In the five cases with malpositioning but no adhesions, the catheters were repositioned in the pelvic cavity. Two catheters had to be withdrawn because of infection. In one case with tunnel infection, the catheters were exchanged simultaneously. There was only one perioperative complication, consisting of temporary dialysate leakage. There were no mechanical or infection problems. The overall success rate of catheter function (>30 days after laparoscopy) was 100%, except for two cases in which the catheters had to be removed.

**Conclusion:** Laparoscopy is a highly effective and successful method for the evaluation and management of peritoneal dialysis catheter dysfunction.

**Key words:** Peritoneal dialysis — Catheter malfunction — Laparoscopy — Renal disease — Kidney

Continuous ambulatory peritoneal dialysis (CAPD) is a fully recognized alternative method to hemodialysis for treating patients with end-stage renal disease. One of the most important aspects of treatment success in CAPD is the presence of a functioning catheter, defined as one that allows adequate inflow and/or outflow of dialysate solution. Catheter malfunction is a common mechanical complication of peritoneal dialysis (PD). It can result from catheter migration or kinking, malposition of the catheter tip, constipation, fibrin deposition, omental wrapping, obstruction secondary to intraperitoneal adhesions, or infection. Options for the management of malfunctioning catheters include urokinase administration, stiff wire manipulation, laparoscopy, and catheter replacement. The purpose of this study was to determine the efficacy of laparoscopy in the management of malfunctioning PD catheters.

### Patients and methods

We reviewed a total of 16 patients with PD who underwent laparoscopy for the evaluation and management of PD catheter dysfunction between November 1994 and June 1999. Recorded data included patient demographics, catheter implantation method, date of malfunction, cause of dysfunction, procedure performed, complications, and catheter outcome.

The laparoscopic procedures were performed under general anesthesia through endotracheal intubation in the outpatient operating room. CO<sub>2</sub> gas was insufflated into the peritoneal cavity via the existing PD catheter, if possible; otherwise it was done through placement of a Veress needle. The CO<sub>2</sub> pneumoperitoneum was maintained at a pressure of 12–14 mmHg. Two trocars were used.

First, a 10-mm trocar was placed away from the catheter insertion site, and a diagnostic laparoscopy was performed to determine the source of the malfunction. An accessory 5-mm trocar was placed as needed for catheter manipulation and to perform adhesiolysis or division of the omentum. Once satisfactory catheter flow and position were achieved, the pneumo-

**Table 1.** Causes and laparoscopic management of catheter dysfunction

Cause	n	Management
Omental and/or small bowel wrapping with adhesions	8	Adhesiolysis
Malposition	5	Repositioning in the pelvic cavity
Infection		
Tunnel infection	1	Simultaneous exchange
Persistent candidiasis	1	Removal of the catheter
Peritonitis	1	Removal of the catheter

peritoneum was released, and the trocar fascial and skin incisions were closed with absorbable suture.

After the procedure, the peritoneum was left to dry overnight. Then PD was started, using small volumes. Regular CAPD was resumed 7 days later. A successful outcome was defined as normal catheter function 30 days after the laparoscopy.

## Results

A total of 16 laparoscopies for catheter malfunction were performed in 16 patients. There were 12 men and 4 women with a mean age of 35.2 years (range, 18–62). All of the patients had chronic renal failure. The catheters had initially been implanted using an open surgical technique in 10 patients and via a blind percutaneous procedure in six patients. The laparoscopic technique had not been used for initial implantation of the PD catheter in any case. Malfunction occurred an average of 5.1 months following insertion (range, 0.5–20). In four cases, attempts at stiff wire manipulation before laparoscopy had failed.

The primary etiology of dysfunction was omentum and/or small bowel wrapping with adhesions in eight cases, malpositioning in five cases, and infection in the remaining three cases (Table 1). Adhesiolysis was performed in the eight cases with adhesions. In the five cases with malpositioned catheters but no adhesions, the catheters were repositioned in the pelvic cavity. In three of these five cases, the catheter tip was in the subhepatic region. During initial implantation, two catheters had been misplaced, one inside an umbilical hernia and the other in the preperitoneal space. The umbilical hernia was repaired after the repositioning. Two catheters had to be withdrawn because of infection (candidiasis and peritonitis). The catheters were exchanged simultaneously in one case with tunnel infection.

The mean operative time was 37 min (range, 20–90). There was only one perioperative complication, consisting of temporary dialysate leakage. The mean follow-up was 14.6 months (range, 6–32). There were no mechanical or infection problems. The overall success rate of catheter function (at >30 days after laparoscopy) was 14/14 (100%), with the exception of two catheters that had to be withdrawn.

## Discussion

Peritoneal dialysis has now become an established and increasingly popular form of renal replacement therapy. CAPD offers advantages in terms of quality of life, but it is still associated with a significant number of complications, such as mechanical problems and infections. Although the

frequency of catheter failure varies from center to center, it is the reason for dropout from CAPD in ~25% of patients. Its success depends on the type of placement technique and the skill of the physician in placing catheters [1]. Peritoneoscopic placement has the lowest incidence of catheter complications and the longest duration of catheter survival of all the methods [1]. Currently, this method has met with great success [6, 7, 8, 9, 14, 15]. Endoscopic catheter implantation was not performed in this study.

Catheter malfunction is common and often occurs shortly after insertion. It has been reported to occur in 2–30% of patients [6]. The causes of catheter malfunction include malpositioning of the catheter tip, catheter migration or kinking, and obstruction of the lumen by a fibrin clot. Catheters sometimes migrate into suboptimal locations, such as the right upper quadrant against the liver. Since catheters drain best when the tip is in the pelvic cavity, they often need to be repositioned. Correction of these complications has been limited to thrombolytic therapy or radiologic manipulation [10, 13]. Failure of these methods inevitably results in surgical replacement. We had unsuccessful attempts with radiologic manipulation in four cases. However, our laparoscopic repositioning technique was successful in all cases with malpositioning. Therefore, we recommend that patients with catheter malfunction be treated primarily with a laparoscopic procedure, even though some patients in this group tolerate anesthetics poorly.

Several recent studies reported that omental wrapping, particularly around the distal portion of the catheter, was the most common cause of the catheter malfunction [3, 5, 11]. Therefore, laparoscopic omentectomy modalities have been used for the management of nonfunctioning PD catheters with omental wrapping [4, 9]. On the other hand, Ögünç's technique [11], which consists of omental fixation onto the peritoneum during laparoscopic CAPD catheter placement, may permit the salvage of peritoneal catheters in cases of omental wrapping. The most common cause of catheter dysfunction in our series was also omental wrapping and adhesions. Brandt and Ricanati [3] reported a success rate of 96% when laparoscopy was used for the management of malfunctioning catheters; this figure is similar to our own results.

Catheter-related infections result in a high rate of patient morbidity, the need for temporary hemodialysis, and substantial costs. Posthuma et al. [12] reported that the simultaneous insertion and removal of a peritoneal dialysis catheter without interruption of peritoneal dialysis was a safe procedure in patients with catheter-related infections. In our one case with tunnel infection, the old catheter was removed after the new catheter was inserted laparoscopically in the opposite abdominal region. However, in two cases, the catheters had to be removed because of catheter candidiasis and peritonitis. Laparoscopic rescue for malpositioning was effective in all cases, despite the two catheters that had to be removed for infectious complications unrelated to the laparoscopic procedure.

When a malfunctioning PD catheter is removed, there is frequently little evidence to show why the device failed. Laparoscopy offers the opportunity to evaluate the etiology of catheter failure, which may then lead to appropriate modifications of technique to avoid recurrent errors in cath-

eter placement [6, 10]. In addition, some authors [2, 7] have suggested that laparoscopy is a safe method for the placement of catheters in patients with prior abdominal surgery. However, like as many other laparoscopic procedures, it is associated with potential risks. In our series, there were no serious complications. In agreement with Brandt and Ricanati [3], we also believe that continuing with peritoneal dialysis in the immediate postoperative period helps to decrease the chance of catheter reocclusion, while also avoiding the need for temporary periods of hemodialysis, which can be expensive. Thus, it is debatable whether laparoscopy leads to higher costs or not. Be that as it may, we found that use of the laparoscopic technique resulted in lower rates of complications, a high rate of catheter salvage, and prolongation of catheter life.

In conclusion, within the limited experience of our institution, we found laparoscopy to be a highly effective method for the evaluation and management of peritoneal dialysis catheter dysfunction. Laparoscopy can be used for the diagnosis and treatment of peritoneal catheter malfunction when conventional maneuvers, such as the primary salvage method, fail to solve this common problem in patients with end-stage renal disease.

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