

Laparoscopic Management of Malfunctioning Peritoneal Dialysis Catheters

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Abstract

Objectives: Continuous ambulatory peritoneal dialysis (CAPD) is an established alternative method to hemodialysis for treating end-stage renal disease patients. Malfunction of the peritoneal catheter is a frequent complication in peritoneal dialysis (PD). Laparoscopy is a minimal invasive technique that allows rescue therapy of malfunctioning catheters and consecutive immediate resumption of PD. The purpose of this study is to present our experiences with laparoscopic repair of peritoneal catheter dysfunction

Methods: Between April 2006 and March 2010, 21 cases of laparoscopic interventions were performed for the salvage of malfunctioning CAPD catheter. Two trocars (5 mm) were used. Recorded data included patient demographics, catheter implantation method, date of malfunction, cause of dysfunction, procedure performed and complications.

Results: The primary etiology of dysfunction was omentum and/or small bowel wrapping with adhesions in fifteen cases, malpositioning in four cases, and tunnel infection in the remaining two cases. Adhesiolysis was performed in cases with adhesions. In the cases with malpositioning but no adhesions, the catheters were repositioned in the pelvic cavity. Two catheters had to be withdrawn and exchanged because of infection. 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 safe, highly effective and successful method for the evaluation and management of peritoneal dialysis catheter dysfunction.

Keywords: Peritoneal dialysis; Catheter malfunction; Laparoscopy.

Introduction

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 aspect 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.

Peritoneal catheter malfunction is a common complication of peritoneal dialysis (PD) necessitating urgent restoration of catheter function. It can result from catheter migration or kinking, malposition of the catheter tip, fibrin deposition, omental wrapping, obstruction secondary to intraperitoneal adhesions, or infection.

Options for conservative, non-surgical management are enema, forced flushing of the catheter, urokinase administration and stiff wire manipulation. Failure to restore catheter function by the above mentioned methods calls for laparoscopy, and catheter replacement.¹ In this publication, we present experience from a single centre with 21 laparoscopic cases for management of malfunctioning PD catheters.

Methods

In this study, a total of 21 patients with PD who underwent laparoscopy for the evaluation and management of PD catheter dysfunction between April 2006 and March 2010 were reviewed. Recorded data included patient demographics, catheter implantation method, date of malfunction, cause of dysfunction, procedure performed and complications.

The laparoscopic procedures were performed under general anesthesia through end tracheal intubation in the operating room. Only in three cases was local anesthesia with intravenous sedation used under supervision of the anesthesiology team as patient general condition cannot tolerate general anesthesia. Carbon dioxide pneumoperitoneum to 12-14 mmHg was achieved by insufflation via the existing PD catheter if possible, otherwise through placement of a Verress needle.

Two trocars were used. First, a 5 mm trocar was placed away from the catheter insertion site, and a diagnostic laparoscopy was performed to determine the source of the

Malfunction (0 degree Laparoscope, 5 mm shaft diameter, Karl Storz, Tuttlingen, Germany). An accessory 5 mm trocar was placed as needed for catheter manipulation and to perform adhesiolysis or division of the omentum. There were no omental pieces left in the catheter. Satisfactory catheter flow and position were achieved, the pneumo 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 immediately, using small volumes. Regular CAPD was resumed one to two days following surgery. A

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successful outcome in immediate functionality ratio was defined as normal catheter function 30 days after the laparoscopy.² There was no suture material used for securing the catheter tip.

Results

From April 2006 to March 2010, a total of 150 PD double-cuffed straight Tenckhoff catheters were implanted at the department of surgery, Dammam University, Saudi Arabia. A total of 21 laparoscopies for catheter malfunction were performed (14% of total cases). The study group comprised of 17 males and 4 females with a mean age of 33.4 years (range: 16- 65). All of the patients had chronic renal failure. Table 1 shows the patient characteristics.

The catheters had initially been implanted using a blind

Table 1: Patient Characteristics

Characteristic		
1	Age: mean \pm (SD)	51 \pm 3.5
2	Sex: M/F ratio	17/4
3	Hypertension	85.7%
4	Ischemic heart disease	47.6%
5	Diabetes Mellitus	33.3%
6	Hepatitis carrier	23.8%

SD = standard deviation

Table 2: Causes and laparoscopic management of catheter dysfunction

Cause	n	Management
1. Omental and/or small bowel wrapping with adhesions	15	Adhesiolysis
2. Malposition	4	Repositioning in the pelvic cavity
3. Tunnel infection(adhesion)	2	Simultaneous exchange

The mean operative time was 30 min (Range: 20-70). There were no mechanical or infection problems. The overall success rate of catheter function (at >30 days after laparoscopy) was 21/21 (100%). The only complication consisted in a case with leakage of the PD fluid due to insufficient closure of one mini-laparotomy access site. Repeat laparoscopy was successful in three cases with reocclusion duration ranged from five to seven months.

Peritoneal dialysis started immediately after laparoscopy and no hemodialysis performed in any of the cases.

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.¹

Positioning of the PD catheter under laparoscopic control was restricted to patients with previous major abdominal interventions or recurrent peritonitis from previous PD therapy.^{3,4} There is

percutaneous procedure in 15 patients and via an open surgical technique in six patients. The laparoscopic technique had not been used for initial implantation of the PD catheter in any of these cases. Malfunction occurred an average of 3.6 months following insertion (Range: 0.5-16 months).

The primary etiology of dysfunction was omentum and/or small bowel wrapping with adhesions in 15 cases, malpositioning in four cases, and tunnel infection in the remaining two cases with extensive adhesions. There was no sign of peritonitis in patients with bowel adhesions causing obstruction. The different video laparoscopic diagnoses in cases of PD catheter malfunction are listed in Table 2.

Adhesiolysis was performed in the 15 cases with adhesions. In the four cases with malpositioned catheters but no adhesions, the catheters were repositioned in the pelvic cavity and fixed with sutures. In three of these four cases, the catheter tip was in the sub-hepatic region. During initial implantation, one catheter had been misplaced in the pre-peritoneal space. Two catheters had to be withdrawn because of tunnel infection. The catheters were exchanged and inserted in the opposite site.

The Tenckhoff catheter (Coiled Peritoneal Silicone Catheter, double cuffed, 56.5 cm, 14.7 FR; Horizon Medical Products®, Manchester, GA, USA) was used for all procedures.

insufficient data regarding long-term catheter survival after laparoscopic placement in patients with previous surgery.^{5,6} In our study, there were 21 case of malfunctioning PD catheter out of the 150 cases (14%). This rate is higher than that reported in a study by Stefano et al. where the rate was 32.8% (25 out of 76 PD case).⁷

Catheter obstruction will manifest as sluggish inflow and/or poor outflow and may be accompanied by abdominal pain. While obstruction may occur with fibrin deposition or catheter migration,⁶⁻⁹ in our study, the most common cause was the wrapping of omentum around the distal portion of the catheter.

Laparoscopic salvage of PD catheters has been reported in the literature on several occasions, the first of which was in 1974, describing the retrieval of a PD catheter.¹⁰ Catheter malfunction is common and often occurs shortly after insertion. It has been reported to occur in 2-30% of patients.¹¹ 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.^{12,13} These problems may cause the catheter to malfunction immediately or several months

after insertion.¹⁴

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 with unsatisfactory results.^{15,16} However, our laparoscopic repositioning technique was successful in all cases. Therefore, we recommend that patients with catheter malfunction be treated primarily with a laparoscopic procedure.

Several recent studies have reported that omental wrapping, particularly around the distal portion of the catheter, was the most common cause of the catheter malfunction.^{17,18} Therefore, laparoscopic omentectomy modalities have been used for the management of nonfunctioning PD catheters with omental wrapping.^{19,20} The most common cause of catheter dysfunction in our series was also omental wrapping and adhesions.

Brandt and Ricanati reported a success rate of 96% when laparoscopy was used for the management of malfunctioning catheters; our study revealed 100% success rate.²⁰

Catheter-related infections result in a high rate of patient morbidity, the need for temporary hemodialysis, and substantial costs. Posthuma et al. 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.²¹ In the current study, for two cases with infection, the old catheter was removed after the new catheter was inserted laparoscopically in the opposite abdominal region.

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 catheter placement.²²⁻²⁵ However, like many other laparoscopic procedures, it is associated with potential risks. In our series, there were no serious complications.

In agreement with Brandt and Ricanati,²¹ 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. Table 3 demonstrate literature review with series of laparoscopic management of malfunctioning peritoneal dialysis catheter^{26,27}

Table 3: A literature review with series of laparoscopic management of malfunctioning peritoneal dialysis catheter

Author	Duration	No. of case	The success rate of the first salvage procedure %
1. Ögünç G ³ 2002	1997-2001	8	100%
2. Lee M ²⁷ 2002	13	92.3%
3. Stefano S ⁷ 2005	25	100%
4. Paneta S ² 2008	2000-2007	56	98.1%
5. Goh HY ²⁶ 2008	2005-2006	18	89%
6. Our study 2010	2006-2010	21	100%

Conclusion

Laparoscopy is a safe highly effective method for the diagnosis, evaluation and management of peritoneal dialysis catheter dysfunction because this procedure is the only technique that can detect pathologic causes of catheters malfunction and can resolve the problems at the same time.

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References

- Diaz-Buxo JA. Management of peritoneal catheter malfunction. *Perit Dial Int* 1998 May-Jun;18(3):256-259.
- Pantea S, Luchian G, Pantea C, Lazăr F, Bordoş D, Păpurică M, et al. The placement of Tenckhoff peritoneal dialysis catheter by laparoscopic approach—our experience. *Chirurgia (Bucur)* 2008 Nov-Dec;103(6):669-672.
- Ogünç G. Malfunctioning peritoneal dialysis catheter and accompanying surgical pathology repaired by laparoscopic surgery. *Perit Dial Int* 2002 Jul-Aug;22(4):454-462.
- Giannattasio M, La Rosa R, Balestrazzi A. How can videolaparoscopy be used in a peritoneal dialysis programme? *Nephrol Dial Transplant* 1999 Feb;14(2):409-411.
- Wang JY, Chen FM, Huang TJ, Hou MF, Huang CJ, Chan HM, et al. Laparoscopic assisted placement of peritoneal dialysis catheters for selected patients with previous abdominal operation. *J Invest Surg* 2005 Mar-Apr;18(2):59-62.
- Ash SR. Bedside peritoneoscopic peritoneal catheter placement of Tenckhoff and newer peritoneal catheters. *Adv Perit Dial* 1998;14:75-79.
- Stefano S, Matthias Z, rita M. Videolaparoscopy as rescue therapy and placement of peritoneal dialysis catheters: a thirty-two case single centre experience. *Nephrol Dial Transplant* 2005;21(5):1348-1354.
- Swartz RD. Chronic peritoneal dialysis: mechanical and infectious complications. *Nephron* 1985;40(1):29-37.
- Cronen PW, Moss JP, Simpson T, Rao M, Cowles L. Tenckhoff catheter placement: surgical aspects. *Am Surg* 1985 Nov;51(11):627-629.
- Kappel IE, Ferguson GM, Kudel RM, Kudel TA, Lawlor BI, pypchuk GB. Stiffwire manipulation of peritoneal dialysis catheters. In: Khanna R, ed. *Advances in peritoneal dialysis*. Toronto: Peritoneal Dialysis Publications Inc., 1995; II: 202-7.
- Cope C, Kramer MS. Letter: Laparoscopic retrieval of dialysis catheter. *Ann Intern Med* 1974 Jul;81(1):121.
- Cooper R, Liszewski R, Kasama R. Applications for laparoscopy in nephrology practice. *Dial Transplant* 1999;28:138-141.
- Fukui M, Maeda K, Sakamoto K, Hamada C, Tomino Y. Laparoscopic manipulation for outflow failure of peritoneal dialysis catheter. *Nephron* 1999;83(4):369.
- Crabtree JH, Fishman A. Laparoscopic epiploxy of the greater omentum and epiploic appendices in the salvaging of dysfunctional peritoneal dialysis catheters. *Surg Laparosc Endosc* 1996 Jun;6(3):176-180.
- Ögünç G. A new laparoscopic approach to salvage a malfunctioning peritoneal dialysis catheter. *Perit Dial Int* 2000;19:493-494.
- Owens LV, Brader AH. Laparoscopic salvage of Tenckhoff catheters. *Surg Endosc* 1995 May;9(5):517-518.
- Siegel RL, Noshier JL, Gesner LR. Peritoneal dialysis catheters: repositioning with new fluoroscopic technique. *Radiology* 1994 Mar;190(3):899-901.
- Campisi S, Cavatorta F, Ramo E, Varano P. Videolaparoscopy with partial omentectomy in patients on peritoneal dialysis. *Perit Dial Int* 1997 Mar-Apr;17(2):211-212.

19. Leung LC, Yiu MK, Man CW, Chan WH, Lee KW, Lau KW
20. Leung LC, Yiu MK, Man CW, Chan WH, Lee KW, Lau KW. Laparoscopic management of Tenckhoff catheters in continuous ambulatory peritoneal dialysis. A one-port technique. *Surg Endosc* 1998 Jun;12(6):891-893.
21. Brandt CP, Ricanati ES. Use of laparoscopy in the management of malfunctioning peritoneal dialysis catheters. *Adv Perit Dial* 1996;12:223-226.
22. Posthuma N, Borgstein PJ, Eijsbouts Q, ter Wee PM. Simultaneous peritoneal dialysis catheter insertion and removal in catheter-related infections without interruption of peritoneal dialysis. *Nephrol Dial Transplant* 1998 Mar;13(3):700-703.
23. Brandt CP, Franceschi D. Laparoscopic placement of peritoneal dialysis catheters in patients with prior abdominal surgery. *Surg Gynecol Obstet* 1994;178:515-516.
24. Watson DI, Paterson D, Bannister K. Secure placement of peritoneal dialysis catheters using a laparoscopic technique. *Surg Laparosc Endosc* 1996 Feb;6(1):35-37.
25. Gholamhossein K, Mohammad-Hadi SM, Alireza. Laparoscopic correction of peritoneal catheter dysfunction. *Indian J Surg* 2009;7:25-27.
26. Goh YH. Omental folding: a novel laparoscopic technique for salvaging peritoneal dialysis catheters. *Perit Dial Int* 2008 Nov-Dec;28(6):626-631.
27. Lee M, Donovan JF. Laparoscopic omentectomy for salvage of peritoneal dialysis catheters. *J Endourol* 2002 May;16(4):241-244.