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The role of laparoscopic surgery in the management of a malfunctioning peritoneal catheter

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ABSTRACT

INTRODUCTION Peritoneal catheter malfunction is a common complication of peritoneal dialysis (PD). It has a high failure rate with conservative management. Catheter replacement was historically the standard surgical treatment of choice. Nowadays, laparoscopy has been introduced as an alternative surgical modality to rescue the malfunctioning peritoneal catheter and also offers the possibility of replacement if indicated. The aim of this study was to compare the outcomes of these two surgical modalities.

METHODS The medical records of consecutive patients who underwent surgical treatment for malfunctioning PD catheters (between January 2010 and April 2013) were analysed. The primary outcome included successful return to adequate PD. The secondary endpoint was length of catheter patency and the cause of catheter failure.

RESULTS A total of 32 cases were identified, of which 8 had open catheter replacement and 24 had a laparoscopic intervention. The overall median follow-up duration was 12.5 months. The success rate for laparoscopic surgery in terms of functioning catheter at 12 months was 62.5% but only 37.5% for open surgery. The mean length of catheter patency after laparoscopic intervention was 31.6 months compared with only 13.6 months for the open surgery group. The most common cause of catheter failure diagnosed during laparoscopic intervention was catheter migration (33.0%), followed by omental wrap and catheter blockage by fibrin/blood plug (25.0% each). Open surgery did not have any diagnostic potential.

CONCLUSIONS Laparoscopy is the treatment of choice for malfunctioning PD. Its proven benefit includes simultaneous identification of the aetiological cause of malfunction together with direct correction of this problem, thereby maximising outcome. It also allows for rapid recommencement of PD and avoidance of haemodialysis, saving cost and resources.

KEYWORDS

Peritoneal dialysis – Catheter malfunction – Laparoscopy

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Peritoneal dialysis (PD) is an effective therapy used widely in the management of patients with end stage renal disease. One of the most important pillars of successful treatment is the presence of a functioning catheter, which allows for adequate inflow and outflow of dialysate fluid. Malfunctioning of the peritoneal catheter is a relatively common complication of PD. It can result from catheter migration, malpositioning of the catheter tip and obstruction secondary to fibrin deposition, omental wrapping or intraperitoneal adhesions.

A number of methods have been described using conservative, non-surgical means to salvage these catheters. These include the use of enemas to induce active bowel peristalsis, infusion of urokinase in order to lyse the fibrin clot, forced flushing of the catheter and the use of a metal guidewire or Fogarty catheter to manipulate the catheter.[1] However, these conservative methods are not effective in the long run and failure to restore catheter function requires surgical intervention. Historically, this entailed removal and replacement of the catheter using open surgery.[2] More recently, laparoscopy has been introduced as an alternative surgical modality to rescue malfunctioning catheters and offers the possibility of replacement under direct vision if indicated.[1,3,4] In this paper, we present our experience from a single centre, comparing the outcomes of open and laparoscopic management of malfunctioning PD catheters.

Methods

The medical records of 32 consecutive patients who underwent surgical treatment for malfunctioning PD catheters (between January 2010 and April 2013) were analysed. The primary outcome measure was successful return to adequate PD. The secondary endpoints were length of catheter patency and cause of catheter failure. Peritoneal catheter malfunction was defined as having poor outflow of dialysate (more than 30min/2l exchange), obstruction or complete occlusion to

inflow and outflow, resulting in inadequate PD or precluding the use of continuous cycle PD.

All cases of catheter malfunction were evaluated using anteroposterior views of an abdominal x-ray. Catheter malpositioning was defined as migration of the tip of the catheter out of the pelvis into the upper abdomen. Malfunctioning was treated conservatively in the first instance, including the use of an enema, infusion of urokinase or forced flushing of the catheter.

The laparoscopic procedures were carried out under general anaesthesia using an endotracheal tube. Prophylactic antibiotics therapy (co-amoxiclav 1.2g, or ciprofloxacin if the patient was allergic to penicillin) was administered at anaesthetic induction. Pneumoperitoneum was attained using a 10mm port, which was inserted supraumbilically using the open Hasson technique. The peritoneal cavity was insufflated with carbon dioxide at a pressure of 12mmHg. A 30° 10mm laparoscope was inserted to explore the abdominal cavity. Two further 5mm ports were inserted under direct vision for the use of surgical instruments.

In cases where the obstruction was due to omental wrapping, the patient was placed in the Trendelenburg position and 25mm atraumatic graspers were used to separate the catheter from the omentum. Thereafter, the tip of the catheter was placed into the pelvis. If the cause of the obstruction was due to fibrin clots, the fibrin was milked out using a combination of an endoscopic grasper and atraumatic forceps. If the catheter malfunction was due to catheter migration out of the pelvis, the tip of the catheter was identified and held by an atraumatic grasper, and placed into the true pelvis. At the end of the procedure, under direct vision, the PD catheter was flushed with 1l of normal saline and the fluid was drained out to check catheter function. The position of the PD catheter was also checked to confirm it was in the right position.

PD catheter replacement under laparoscopy was performed in cases in which, laparoscopically, the catheter position could not be corrected. In addition to the laparoscopic ports, a mini-laparotomy was made infraumbilically; a PD catheter (PDCATH® CA 3257, 57cm, coiled; Gambro, Peterborough , UK) was inserted and directed towards the pelvis. The position was checked by the laparoscope and a purse string suture was tightened at the level of the internal cuff of the catheter. A curved tunneller was used to create the exit site in a lateral downward orientated position.[5] The mini-laparotomy site was closed in an oblique manner from the lower to the upper part.

At the end of surgery, catheter function (inflow and outflow) was tested with saline irrigation. In those patients who had laparoscopic salvage of their PD catheter, PD was commenced the following day after surgery.

Results

In the study period, a total of 32 patients (24 male, 8 female) developed PD catheter malfunction following insertion of the double cuffed PDCATH® coiled Tenckhoff catheter using the open surgical technique. The patients' characteristics and renal status is given in Table 1, and the aetiology of their chronic renal failure is given in Table 2. Eight patients in the study cohort had open replacement of their PD catheter while the rest (n=24) had a laparoscopic intervention. The median follow-up duration was 12.5 months (interquartile range: 6.00–18.55 months). There were no complications or conversions to open surgery in the cohort of patients with the laparoscopic intervention. Two patients who died in the follow-up period but this was unrelated to PD.

In terms of success for both procedures (ie functioning catheter at 12 months), the open surgery group had a success rate of 37.5% (3 patients out of 8) while the

Table 1 Patient characteristics

	Open surgery	Laparoscopic surgery
Age in years		
Median (IQR)	44.0 (32.8–67.8)	48.5 (41.3–77.5)
Sex		
Male	6	17
Female	2	7
Body mass index in kg/m^2		
Median (IQR)	26.9 (20.4–32.5)	27.8 (23.8–31.2)
Renal status		
Predialysis	7	15
Haemodialysis	1	8
Failed transplant	0	1

IQR = interquartile range

Table 2 Aetiology of end stage renal disease

Cause	Number of patients	
	Open surgery	Laparoscopic surgery
Diabetic nephropathy	3	9
Immunoglobulin A nephropathy	1	4
Reflux nephropathy	1	2
Congenital renal dysplasia	1	1
Cystinosis	1	
Henoch–Schönlein purpura	0	1
Lupus nephritis	0	1
Malignant hypertension	0	1
Adult polycystic kidney disease	0	1
Recurrent pyelonephritis	0	1
Focal segmental glomerulosclerosis	0	1
Unknown	1	2
Total	**8**	**24**

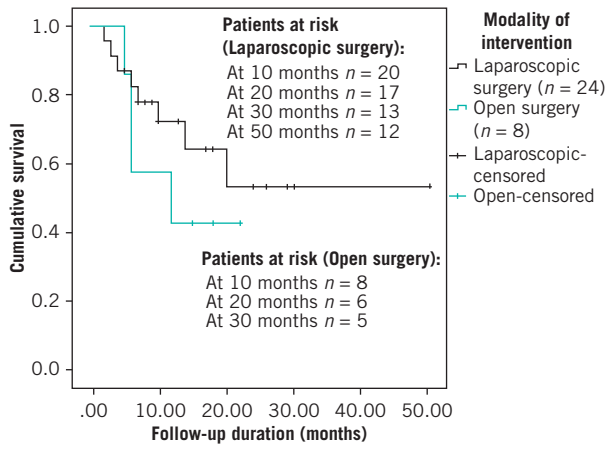

Figure 1 Kaplan–Meier curve showing length of survival of peritoneal dialysis catheter after surgical intervention

laparoscopic group had a success rate of 62.5% (15 patients out of 24). The mean length of catheter patency in the laparoscopic cohort was 31.6 months (95% confidence interval [CI]: 21.5–41.6 months) compared with 13.6 months (95% CI: 7.9–19.2 months) in the open surgery group (Fig 1).

In the patients who underwent a laparoscopic intervention, the most common cause of PD malfunction was malpositioning of the catheter, followed by omental wrap and fibrin/blood clot in the PD catheter. The causes of the PD catheter malfunction and management are given in Table 3. In one patient who had extensive adhesions in the pelvis, the PD catheter had to be removed. The catheter had to be replaced laparoscopically in two patients in whom it could not be returned into the true pelvis despite laparoscopic manipulation.

PD was commenced successfully within 48 hours of laparoscopic salvaging of the PD catheter.

Table 3 Aetiology and management of peritoneal dialysis catheter malfunction in laparoscopic group

Cause of failure	Number of patients	Management
Malpositioning	8 (33.0%)	Repositioning in the pelvic cavity Replacement of catheter (*n*=1)
Omental wrap	6 (25.0%)	Unwrapping/adhesiolysis Replacement of catheter (*n*=1)
Fibrin/blood plug	6 (25.0%)	Unblocking
Adhesions	3 (13.0%)	Adhesiolysis Removal of catheter
Ovarian wrap	1 (4.0%)	Unwrapping/adhesiolysis
Total	**24 (100%)**	

Discussion

PD is an important mode of therapy in patients with end stage renal disease, particularly in those without vascular access for haemodialysis. It offers significant advantages especially in terms of quality of life to this cohort of patients but it is associated with significant complications including PD catheter malfunction, which may lead to discontinuation of this therapeutic modality of treatment.[3,6] Catheter malfunction can occur as a result of displacement of the PD catheter tip out of the pelvis, obstruction of the lumen by fibrin and blood clots, omental wrapping, and adhesions in the abdomen and pelvis.[7–9] The incidence of catheter malfunction ranges between 12% and 73% of patients.[10]

The use of laparoscopic surgical techniques in salvaging malfunctioning PD catheters has revolutionised the management of this condition.[11] This technique facilitates the simultaneous identification and correction of problems, which may complicate PD and facilitate early return to dialysis.[8]

In contrast, the open surgical technique (ie replacement of the PD catheter) does not allow for a diagnosis of the aetiological factor causing the catheter malfunction and is therefore associated with an increased likelihood of recurrence of the problem, as was demonstrated in our study (success rate of 37.5%). In addition, this group of patients cannot resume PD for about six weeks after the procedure to facilitate healing. Consequently, a number of these patients, especially those requiring dialysis, would need to be commenced on haemodialysis in the interim period, which is associated with financial burden, morbidity and a decrease in the patient's quality of life.

Various studies have shown that migration of the catheter tip from the pelvis is the most common laparoscopic finding, which varies between 5% and 56%.[8,9,12,13] This was also the finding in our study. PD catheters tend to drain best when the tip is in the pelvic cavity; hence, they often need to be repositioned. In our study, the laparoscopic repositioning technique was successful in three-quarters of the patients. Omental wrapping, particularly around the distal portion of the catheter, is another frequent cause of PD catheter malfunction.[1,14] It was responsible in a quarter of our patients. Studies have shown that laparoscopic repositioning and adhesiolysis with/without omentectomy are simple techniques that may prolong catheter survival.[13] Only one patient (16.7%) in our cohort with omental wrapping (*n*=6) required a laparoscopic replacement of the PD catheter because of the inability to maintain the placement of the salvaged PD catheter in the pelvis.

One patient had extensive dense adhesions in the pelvis. The decision was made to remove the PD catheter and commence the patient on haemodialysis.

In the literature, multiple studies have shown successful laparoscopic manipulation of obstructed catheters with salvage rates ranging between 50% and 96%.[3,7,9,13] Our technique of primary laparoscopic PD catheter salvaging had a success rate of 62.5%, which is comparable with other studies.

The main weaknesses of this study are the small cohort size and the potential risk of selection bias due to the fact that this was an observational study.

Conclusions

Laparoscopy is the treatment modality of choice in selected patients with malfunctioning PD catheters as this procedure allows the simultaneous identification of the aetiology and correction of the problem, thereby optimising outcome. It also allows for rapid recommencement of PD with avoidance of haemodialysis, saving cost and resources.

References

1. Santarelli S, Zeiler M, Marinelli R *et al*. Videolaparoscopy as rescue therapy and placement of peritoneal dialysis catheters: a thirty-two case single centre experience. *Nephrol Dial Transplant* 2006; **21**: 1,348–1,354.
2. Mutter D, Marichal JF, Heibel F *et al*. Laparoscopy: an alternative to surgery in patients treated with continuous ambulatory peritoneal dialysis. *Nephron* 1994; **68**: 334–337.
3. Zakaria HM. Laparoscopic management of malfunctioning peritoneal dialysis catheters. *Oman Med J* 2011; **26**: 171–174.
4. Taskesen F, Arikanoglu Z, Uslukaya O *et al*. Laparoscopic salvage for malfunctioning of peritoneal dialysis catheters. *Minerva Chir* 2012; **67**: 505–509.
5. Favazza A, Petri R, Montanaro D *et al*. Insertion of a straight peritoneal catheter in an arcuate subcutaneous tunnel by a tunneler: long-term experience. *Perit Dial Int* 1995; **15**: 357–362.
6. Diaz-Buxo JA. Management of peritoneal catheter malfunction. *Perit Dial Int* 1998; **18**: 256–259.
7. Zoland MP, Loubeau JM, Krapf R, Zabetakis PM. A simplified laparoscopic salvage technique for malfunctioning chronic peritoneal dialysis catheters. *Perit Dial Int* 1997; **17**: 610–612.
8. Ogünç G. Malfunctioning peritoneal dialysis catheter and accompanying surgical pathology repaired by laparoscopic surgery. *Perit Dial Int* 2002; **22**: 454–462.
9. Kazemzadeh G, Modaghegh MH, Tavassoli A. Laparoscopic correction of peritoneal catheter dysfunction. *Indian J Surg* 2008; **70**: 227–230.
10. Bernardini J. Peritoneal dialysis catheter complications. *Perit Dial Int* 1996; **16**: S468–S471.
11. Barone GW, Johnson DD, Webb JW. A practical approach to laparoscopic surgery for malfunctioning peritoneal dialysis catheters. *J Laparoendosc Adv Surg Tech A* 1998; **8**: 19–23.
12. Kim HJ, Lee TW, Ihm CG, Kim MJ. Use of fluoroscopy-guided wire manipulation and/or laparoscopic surgery in the repair of malfunctioning peritoneal dialysis catheters. *Am J Nephrol* 2002; **22**: 532–538.
13. Yilmazlar T, Kirdak T, Bilgin S *et al*. Laparoscopic findings of peritoneal dialysis catheter malfunction and management outcomes. *Perit Dial Int* 2006; **26**: 374–379.
14. Campisi S, Cavatorta F, Ramo E, Varano P. Videolaparoscopy with partial omentectomy in patients on peritoneal dialysis. *Perit Dial Int* 1997; **17**: 211–212.