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Laparoscopic salvage of malfunctioning peritoneal catheters

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Abstract
Background: Malfunction of peritoneal catheters due to mechanical outflow problems is an annoying complication in patients undergoing chronic peritoneal dialysis (PD). Correction often involves catheter replacement or revision via laparotomy.
Methods: Twenty-five patients undergoing PD who developed mechanical catheter flow restriction underwent 28 laparoscopic procedures. Preoperative diagnoses were made by contrast catheter radiography and were: catheter sequestration (36%), omental wrap (64%). Pneumoperitoneum was induced after general anesthesia and laparoscopy was performed using a Storz laparoscope. The catheter was then identified and manipulation was attempted using instruments placed percutaneously.
Results: In 26 cases (93%), the catheter was freed and function restored. In two cases (7%), adhesions were so numerous and dense that the distal catheter could not be visualized. Four episodes of peritonitis occurred in the perioperative period. Four patients developed subcutaneous leakage of peritoneal fluid which responded to cessation of PD for 2 weeks. Four patients had recurrent occlusions; three of these were managed laparoscopically. Two patients developed late hernias at the site of insertion of the laparoscope. Catheter patency averaged 9.2 months postoperatively.
Conclusions: Laparoscopic revision is a successful technique for salvage of occluded peritoneal catheters.

Key words: Peritoneal catheters — Malfunction — Laparoscopy — Repair — Omentum — Adhesions

Mechanical obstruction of peritoneal dialysis catheters is a frustrating problem that occurs in 2–30% of patients treated by this modality [8, 15]. Severe obstruction often leads to catheter loss, interruption of peritoneal dialysis, and treatment failure. When it is due to fibrin plugging or adhesion, thrombolytic therapy with urokinase is frequently successful [4]. Migration of the catheter tip may be associated with outflow obstruction, though in our experience, this usually signifies omental wrapping. Simple displacement of a free catheter does not interfere with outflow [17]. Repositioning by external guidewire manipulation yields poor long-term results and is problematic in catheters with predefined bends and coiled intraperitoneal segments [13]. Successful treatment of omental wrapping or catheter sequestration has typically required laparotomy with omentectomy and manual repositioning of the catheter, or removal and replacement of the malfunctioning catheter. With the advent of high-resolution laparoscopic surgery, it has become possible to perform complex intra-abdominal procedures with a minimum of cutting and dissecting. Since 1991 we have employed laparoscopic techniques to repair malfunctioning peritoneal catheters. This approach offers significant advantages over traditional surgical methods.

Materials and methods

Twenty-five patients aged 26–73 on peritoneal dialysis for 0–20 months developed mechanical catheter dysfunction over a 4-year period (Table 1).

The cause of obstruction was diagnosed by contrast catheter radiography in all cases and was confirmed at operation (Fig. 1). The causes were omental wrap (18/28; Fig. 2) and sequestration by adhesions (10/28).

All procedures were performed under general anesthesia. Prophylactic antibiotics were given routinely; either intravenous cefazolin (1 g) or intravenous vancomycin (1 g) and gentamicin (80–100 mg). A 10/11-mm trocar was used at a periumbilical site for the laparoscope. Pneumoperitoneum was induced and the catheter was located and traced to the site of obstruction. In addition to the laparoscope trocar, two 5-mm trocars were used for seven procedures and three for 21. These were used to introduce instruments and were positioned to achieve maximum leverage relative to the catheter. When omental wrap was identified, simple stripping of the omentum usually released the catheter (Fig. 3). In four cases, the catheter was exteriorized for more meticulous debridement. Lysis of adhesions was performed using electrocautery or blunt dissection. Once freed, the catheter was repositioned within the pelvis. Partial omentectomy was carried out in five patients using the EndoGIA device. At this point, the catheter was irrigated with heparinized dialysate to assure hydraulic function and to prevent clotting within the catheter. Ports were removed and the sites were closed with nonabsorbable sutures using the Advanced Surgical trocar closing device. (The first 13 cases were performed before adequate fascial closure systems were available.) Catheter function was reconfirmed with heparinized dialysate; 250–500 cc was left within the peritoneal cavity to prevent clot formation.

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Table 1. Patient characteristics and utcome after laparoscopic catheter revision[a]

Proc. #	Pt. #	Age/sex	Cause ESRD	Months on CPD	Cause obstruct	Cath type	Duration (mos)	Outcome	Complications
1	1	26 M	RPGN	13	Sequest	Cruz	4	Tx Hd	Peritonitis
2	2	72 M	Atheroemb	14	Sequest	Cruz	4	Tx HD	Peritonitis
3	3	58 M	HTN	<1	Sequest	Tenck	0	Expired	Peritonitis
4	4	32 F	HTN	<1	Oment wrap	Cruz	22	Tx HD	Hernia
5	5	67 M	HTN	17	Sequest	Crux	4	Tx HD	Leak
6	6	36 M	DM	1	Oment wrap	Cruz	5	Tx HD	Leak
7	7	44 M	HIVAN	2	Oment wrap	Cruz	2	Tx HD	Leak
8	8	31 F	HTN	<1	Oment wrap	Cruz	36	On PD	
9	9	46 F	DM	20	Oment wrap	Cruz	36	On PD	Leak
10	10	38 M	HIVAN	<1	Oment wrap	Cruz	1	Tx HD	Recurred
11	11	73 F	DM	<1	Oment wrap	Cruz	17	On PD	Hernia
12	12	71 F	HTN	<1	Sequest	Tenck	11	On PD	
13	13	52 F	DM	<1	Sequest	Tenck	17	On PD	
14	14	53 F	HTN	<1	Sequest	Tenck	15	On PD	
15	15	59 M	DM	<1	Oment wrap	Cruz	17	On PD	
16	16	33 M	HIVAN	1	Oment wrap	Cruz	3	Recurred	Recurred
17	16				Oment wrap	Cruz	8	On PD	
18	17	30 M	SLE	1	Oment wrap	Cruz	12	On PD	Cath replaced
19	18	31 M	HIVAN	<1	Oment wrap	Cruz	1	Recurred	Recurred
20	18				Oment wrap	Cruz	3	Expired	
21	19	54 M	HTN	1.5	Oment wrap	Cruz	7	On PD	Cath replaced
22	20	49 M	HIVAN	<1	Oment wrap	Cruz	5	On PC	
23	21	46 M	HIVAN	12	Sequest	Cruz	0	Tx HD	Failed
24	22	50 M	DM	<1	Oment wrap	Cruz	4	Tx HD	
25	23	69 M	HTN	<1	Sequest	Cruz	1	On PD	Scrotal emphysema
26	24	45 M	DM	6	Oment wrap	Cruz	8	Recurred	Recurred
27	24		DM		Oment wrap	Cruz	3	On PD	Peritonitis
28	25	58 M	DM	<2	Sequest	Cruz	12	On PD	

[a] RPGN = rapidly progressive glomerulonephritis; atheroemb = atheroembolic disease; HIVAN = HIV-associated nephropathy, Cruz = Cruz catheter; Tenck = Tenckhoff catheter; DM = Diabetes mellitus; HTN = Hypertension; SLE = systemic lupus erythematosus; Sequest = catheter sequestered by adhesions; Oment wrap = Omental wrap; OnPD = Remains on peritoneal dialysis; TxHD = Transferred to hemodialysis.

Results

Operative time ranged from 40 to 120 min. In all but two cases, the catheter was freed and function was restored. In two cases, adhesions were so dense that the distal catheter could not be visualized. Lysis of adhesions in one patient permitted PD to be continued for 3 months with adequate volumes. In the other patient, the catheter was subsequently removed.

Catheters remained patent for a mean of 9.2 months (range: 0–36). Ten catheters remain functional at the time of this writing.

Four of 25 patients developed peritonitis in the perioperative period. In three of these the infection resolved with antibiotics within 1 week. In the other, the catheter again became occluded and the patient expired before the catheter could be removed. This was the only perioperative death. It was apparent that this patient had florid peritonitis at the time of laparoscopy. Three of the four episodes of peritonitis occurred during the early period of our experience, before routine antibiotic prophylaxis was used. Only one episode of perioperative peritonitis has been documented since adopting this measure. In four of 28 procedures, patients experienced subcutaneous leakage of peritoneal fluid. This manifested as either leakage at the exit site or as scrotal edema. All resolved with cessation of PD for 2 weeks. These episodes of leakage were presumed to be due to breeches of peritoneal integrity at the trocar sites. Once this was recognized as a complication, patients were either maintained on hemodialysis for 1–2 weeks or admitted for low-volume, high-frequency PD. As we developed experience with port-site closure technique, fluid leakage disappeared. No leakage has been noted since using the newer endoscopic port closure devices, and we are able to resume full volume exchanges immediately.

Two of 25 patients developed a significant hernia at the site of laparoscope insertion. Both underwent surgical correction of the hernia. With improved site closure we have not seen any hernia in the later series.

One patient developed mild scrotal emphysema postoperatively which resolved spontaneously over 24 h.

Not including the patient described above with intercurrent peritonitis who expired a week after the procedure, four patients developed recurrent occlusions. All had omental wraps. Two reoccluded within 4 weeks of revision, one after 12 weeks, and another after 8 months. Three of the four were successfully revised laparoscopically. The fourth elected to transfer to hemodialysis and the catheter was removed.

When the procedure was performed on stable outpatients, they were able to go home the same day. There were no acute complications that necessitated hospitalization. There were no episodes of bleeding, and in no case was laparotomy required. Postoperative pain was mild to moderate and readily controlled with oral analgesics.

Discussion

Cunningham and Tucker used peritoneoscopy to evaluate two peritoneal dialysis patients with peritonitis in 1983 [7].

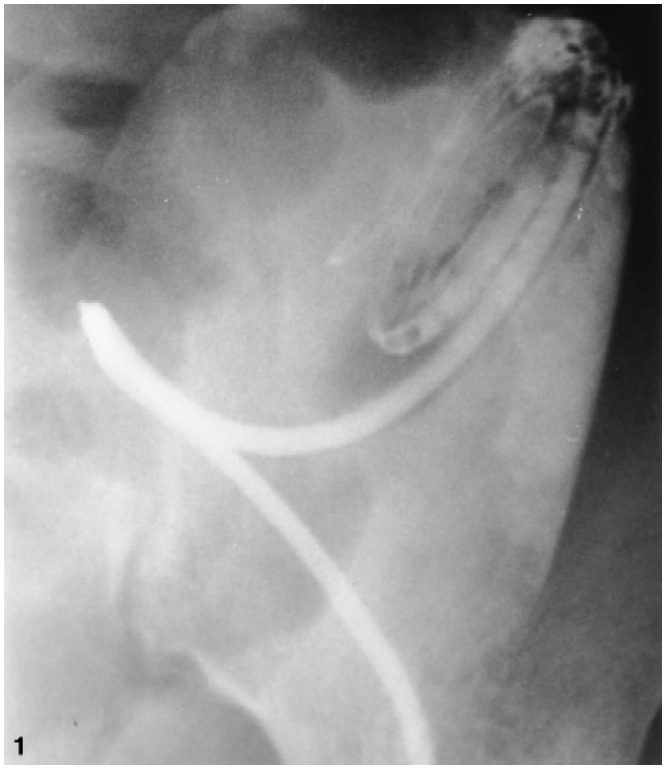

Fig. 1. Typical radiographic appearance of omental wrap. Catheter is displaced out of the pelvis. Contrast lines both the lumen and the exterior of the catheter, and intraluminal filling defects, representing ingrowth of omentum, are seen.

Fig. 2. Omentum wrapped around catheter at point of entry into peritoneal cavity.

Fig. 3. Omentum being stripped from catheter.

Wilson and Swartz were the first to describe the laparoscopic correction of a poorly functioning peritoneal catheter [18]. Since then, others have used laparoscopic techniques to implant [1–3, 16] and revise [5, 9–11, 14] peritoneal catheters.

Laparoscopy is a relatively noninvasive approach to catheter salvage. It can be performed by any surgeon experienced with laparoscopic technique, and in most cases it can be done on an ambulatory basis, which saves costs. The traditional laparotomy with omentectomy and manual catheter repositioning is a major procedure with a prolonged recovery period. Removal and replacement of the catheter necessitates the creation of a new exit site and tunnel which then must mature.

The postoperative complications of subcutaneous fluid leakage and hernia formation have been eliminated by meticulous closure of the fascia.

Recurrence of omental wrapping has been bothersome. Of the four instances, one had undergone omentectomy at the time of revision. One approach may be to suture the omentum to the anterior abdominal wall [12]. Residual devitalized omental tissue left within the catheter lumen has not caused obstruction.

In conclusion, laparoscopic manipulation of occluded

peritoneal dialysis catheters is a useful technique for catheter salvage. It has the advantage of permitting early resumption of peritoneal dialysis, which greatly simplifies the management of these patients.

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