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Laparoscopic introduction of a continuous ambulatory peritoneal dialysis (capd) catheter by a two-puncture technique

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Abstract. We describe a laparoscopic two-puncture technique for the placement of a continuous ambulatory peritoneal dialysis catheter. With a mean follow-up period of 8 months the short-term results of the first 19 laparoscopic catheter insertions are evaluated and discussed. It appears to be a simple, safe, and viable procedure with a low morbidity and very good results in the short term. The same technique can also be used in catheter salvage in case of outflow obstruction or catheter migration, thus increasing catheter longevity.

Key words: Chronic renal failure — laparoscopy — Peritoneal dialysis — Continuous ambulatory peritoneal dialysis — Continuous ambulatory peritoneal dialysis catheter — Tenckhoff catheter

Peritoneal dialysis is an effective method of renal replacement therapy for patients with end-stage renal disease. As worldwide, in The Netherlands the number of patients on dialysis therapy is increasing every year. At the same time peritoneal dialysis is becoming more and more popular. In 1987 nearly 20% of all Dutch dialysis patients were on peritoneal dialysis. At the end of 1994 this increased to 29% and it is expected that in 1996 one-third of all dialysis patients will be on peritoneal dialysis [13].

In our institution, peritoneal dialysis is achieved by continuous ambulatory peritoneal dialysis (capd) using a curled, Swan-neck, dual-cuff Tenckhoff catheter.

Although peritoneal dialysis has many advantages (simplicity of the technique, increased patient mobility and independency, less transfusions, and lower costs), this type of dialysis is associated with many complications, including infections (exit-site infections or persisting peritonitis), outflow obstruction, cuff extrusion, catheter dislodgement, subcutaneous leakage, genital edema, and respiratory compromise [2, 4, 6, 9, 14–16]. Outflow obstruction is one of the major problems, which is reported to occur in up to 60% of the patient, often necessitating catheter removal or replacement [2, 4, 6, 8, 14, 15]. In order to minimize the risk of outflow obstruction a correct positioning of the catheter seems to be important. In March 1994 we started to introduce capd catheters laparoscopically by a two-puncture technique in order to have visual control of a correct positioning. This technique and the early results are presented and discussed in this report.

Patients and methods

Between March 1994 and February 1995 some 19 Tenckhoff catheters were laparoscopically placed in 19 patients with end-stage renal disease.

There were 13 men and 6 women, with a mean age of 50.7 years (ranging from 28 to 75 years). The causes of renal failure are listed in Table 1.

In 13 patients it was the first time a capd catheter was placed; the others had had one or more (open) catheter insertions before (up to eight times!). In four patients their former catheter was removed 3–4 weeks prior to the laparoscopic placement because of infection. In the other two patients the capd catheters were removed in the past because of a rupture of an abdominal aortic aneurysm and because of a kidney transplant, which was rejected later. Nine patients had previous abdominal operations varying from capd catheter placement to a ruptured abdominal aortic aneurism (Table 2).

Operative procedure

The patient, positioned in a supine position, is placed under general endotracheal anesthesia. Prophylactically flucloxacillin is given in a dose of 6 times 1 g i.v. during 24 h. A pneumoperitoneum is created using a Karl Storz 4.5-mm trocar/Veress needle (Fig. 1) which is introduced in the contralateral upper abdominal quadrant. A 3.5-mm Karl Storz Hopkins II zero° telescope is inserted through this trocar. As we are used to do in other laparoscopic procedures, we always start with an examination of the abdominal cavity. Special attention is paid to the presence of adhesions or herniations, to the extent of the greater omentum, and to the most suitable site to introduce the catheter.

Then an 1.5–2-cm-long skin incision is made in the paramedian site of

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Table 1. Cause of renal failure

Disease	Number of patients
Glomerulosclerosis	6
Polycystic kidney disease	4
Reflux pyelonephritis	4
Interstitial nephritis	2
Nephrolithiasis	1
Diabetes mellitus	1
Other	1

Table 2. Previous abdominal operations and intraoperative findings

Patient	Previous operation	Intraoperative findings
A	5 × capd—kidney transplant	Adhesions in left lower abdominal quadrant
B	2 × capd—resection of a ruptured abdominal aortic aneurysm	Multiple adhesions in midline
C	1 × capd—appendectomy—kidney transplant—incisional hernia repair	Multiple adhesions in lower abdomen and left upper abdominal quadrant
D	1 × capd—nephrectomy	Normal
E	8 × capd	Normal
F	1 × capd	Normal
G	"Open" cholecystectomy—common bile duct exploration	Adhesions in right upper abdominal quadrant
H	"Open" cholecystectomy	Normal
I	"Open" cholecystectomy	Normal

the ipsilateral lower abdomen. After blunt dissection of the subcutis the anterior rectus sheath is transversely incised. By blunt dissection we create some space for the introduction of a reusable 10-mm trocar. Under visual control this device is directed caudally in front of the transversal fascia and peritoneum (Fig. 2a). Care must be taken not to injure the inferior epigastric vessels. The trocar is then introduced into the abdominal cavity and the curled tip of the Tenkhof catheter is positioned in the pouch of Douglas (Fig. 2b,c). The cannula is removed and the catheter is withdrawn (Fig. 2d) so that the deep cuff is situated within the rectus muscle.

After the anterior rectus sheath is closed with interrupted sutures of 2-0 Vicryl, the subcutaneous tunnel is made in a lateral and downward direction, bringing the exit site below the belt. We make sure that there is no kinking and that the proximal (subcutaneous) cuff is situated at some distance from the exit site.

At the end of the procedure the intraabdominal position is checked once more and the catheter is tested using sterile saline. The abdominal cavity is desufflated and the 4.5-mm trocar is removed. The small skin incisions are closed with tapes.

Usually peritoneal dialysis is started 5–6 days after surgery.

Although not discussed here, the same technique can be used in case of catheter dislocation or outflow problems. In those cases the pneumoperitoneum can be created using the catheter that is already in situ. The 4.5-mm Storz trocar and telescope are introduced in the contralateral upper abdominal quadrant.

In some cases we succeeded in repositioning the catheter by using only the telescope. In most cases, however, we had to introduce a second, reusable 5-mm trocar in the contralateral lower abdominal quadrant. With a grasper the catheter is repositioned, or, in case of outflow problems, it is freed from omental wrapping and adhesions.

After checking the position of the tip the catheter is tested, the abdomen is desufflated, and trocard are removed.

Results

In all patients the catheter was laparoscopically placed in the desired position. Adhesions were seen in six patients.

Fig. 1. The 4.5-mm Storz Veress needle with combined cannula.

All of them had had previous abdominal operations. Simultaneous adhesiolysis was performed in three of them.

The mean operation time was 34 min (ranging from 17–53 min). There was no mortality and there were no intraoperative complications.

In all patients peritoneal dialysis was started 5–6 days after catheter placement. In one patient it had to be stopped temporarily because of subcutaneous leakage of dialysate. Peritoneal dialysis was successfully restarted 16 days after surgery.

Figure 3 shows the catheter-related complications. Most patients had no problems. The most frequent complication was a superficial exit site infection, which was seen in four patients. These infections started 1–8 weeks after insertion and all could be managed conservatively using cephalexin and mupirocin.

A deep tunnel infection with subsequent peritonitis was encountered in one patient. After conservative therapy failed, the catheter had to be removed 18 days after placement. This patient had had eight (open) capd catheter placements before, which were nearly all lost because of infectious problems. This patient appeared to be colonized by *Staphylococcus aureus,* meaning the definitive end of peritoneal dialysis; he is now on hemodialysis.

Outflow obstruction was seen in only two patients. In the first patient it started after removal of a rejected kidney transplant in another hospital 4 months after insertion of the catheter. In the second patient in- and outflow problems began 2 weeks after placement. In both patients obstruction

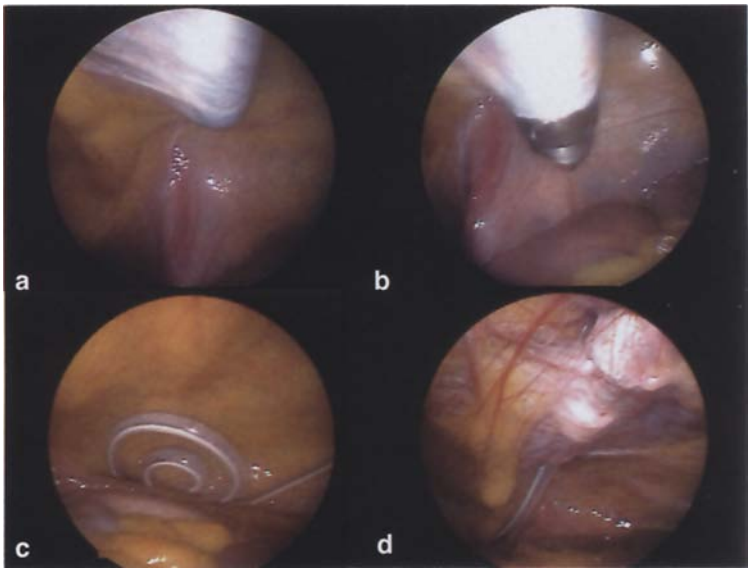

Fig. 2. a–d The introduction of the trocar into the abdominal cavity, the placement of the catheter, and the withdrawal of trocar and catheter.

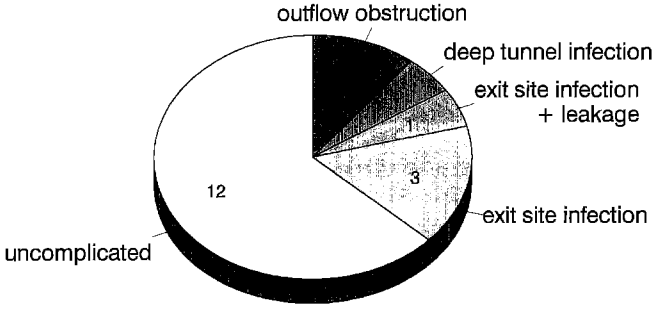

Fig. 3. Catheter-related problems.

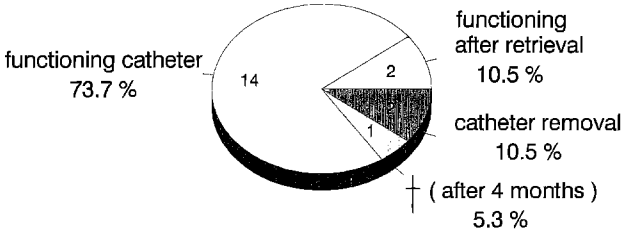

Fig. 4. Follow-up.

resulted from adhesions and omentum wrapping around the tip. Laparoscopic adhesiolysis could be performed successfully. Both catheters are still functioning well, respectively, 5 and 6 months after retrieval.

The median follow-up period is 8 months, ranging from 18 days to 15 months.

To date, 16 patients have well-functioning catheters and remain on peritoneal dialysis (Fig. 2). One patient died from a cardiac arrest 4 months after catheter placement. At that time his catheter was functioning well. There were two catheter removals because of persisting peritonitis. In one patient the Tenckhoff was removed after 18 days because of a deep tunnel infection, as mentioned before. In the other patient the catheter had to be removed 4.5 months after surgery because of a severe peritonitis due to diverticulitis of the sigmoid. Recently a new catheter was laparoscopically placed, which is still functioning well.

Discussion

Peritoneal dialysis is still gaining popularity in the treatment of patients with end-stage renal disease. At the end of 1994, in The Netherlands, 29% of 3,843 patients on dialysis therapy were on some form of peritoneal dialysis [13].

However, despite the widespread acceptance of this therapy, it is still associated with a relatively high complication rate. The most frequent complication is peritonitis, which accounts for more than 30% of capd failures [12]. Outflow obstruction is a very common mechanical problem which is reported to occur in up to 60% of the patients [2, 4, 6, 8, 14, 15]. This obstruction usually results from peritonitis, from adhesions following previous infection or operation, from catheter migration out of the pelvis, or from omental wrapping [6–8, 11]. Outflow problems usually necessitate catheter removal or replacement. Laparoscopic techniques have proven to be useful in the placement, retrieval, and repositioning of capd catheters [1, 3, 5, 7, 8, 10, 17].

In this report we describe a laparoscopic two-puncture technique for the placement of a peritoneal catheter which can also be used in retrieval and repositioning of existing catheters.

In all patients the Tenckhoff catheter was easily placed laparoscopically, in three patients after more or less extensive adhesiolysis. A pneumoperitoneum could be created by a closed puncture technique in all but one patient. In that case we decided to perform an open introduction of the 4.5-mm trocar/Verress needle, because the patient had had multiple previous abdominal operations, making it difficult to achieve safe access to the peritoneal cavity.

Our series show that this laparoscopic procedure can be performed safely: there was no mortality and there were no intraoperative complications. Postoperative morbidity rate was also low. Most frequently an exit-site infection was

encountered, which in all cases could be managed by conservative measures. A more serious infectious complication is a deep tunnel infection with subsequent peritonitis. This complication was seen in only one patient, necessitating catheter removal 18 days after placement. In fact, that was the only catheter-related peritonitis in our series, because the second case of peritonitis was caused by a diverticulitis of the sigmoid.

The incidence of outflow obstruction was relatively low. In only two patients were outflow problems encountered, and in one of them they appeared to be due to adhesions following a laparatomy to remove a rejected kidney transplant 4 months after insertion. Both dysfunctioning catheters were revised by laparoscopic adhesiolysis. This laparoscopic approach to a malfunctioning catheter offers some important advantages: the cause of the malfunction can be determined and simultaneously be treated, and the catheter can be repositioned.

The low incidence of outflow obstruction in our series may be a result of the accurate placement under direct visualization; on the other hand it may be affected by the relatively short follow-up period.

The results in the short term are very good (Fig. 4). After a median follow up of 8 months 18 patients are still alive. Two laparoscopic retrievals included, 89% of them have well-functioning catheters. In two patients catheters had to be removed because of peritonitis. One of those patients is now on hemodialysis, and in the other a new Tenckhoff catheter was recently placed laparoscopically.

Laparoscopic placement of a capd catheter by this two-puncture technique is a simple, safe, and viable procedure, even in patients with multiple previous abdominal operations. The same technique can be used to rescue dysfunctional capd catheters which are dislodged or obstructed by omental wrapping and adhesions, thus increasing catheter longevity.

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