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Laparoscopic Placement of the Tenckhoff Catheter for Peritoneal Dialysis

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Summary: Continuous ambulatory peritoneal dialysis catheters can be inserted by open laparotomy as well as by laparoscopy. A prospective randomized study was scheduled to investigate the results of the laparoscopic versus open laparotomy technique for placement of continuous ambulatory peritoneal dialysis catheters. Fifty patients were enrolled and randomly allocated into two groups of 25 patients each. Group A underwent continuous ambulatory peritoneal dialysis catheter placement via the open laparotomy technique. In 22 patients, catheters were inserted via midline incision, and in 3 patients with histories of previous catheterization, a paramedian incision was used. Continuous ambulatory peritoneal dialysis was started 24 to 48 hours later. Group B underwent laparoscopic placement of the catheter with fixation into the pelvis and suture closure of the port wounds. In 21 patients, this catheter placement was the first such placement, and in 4 patients, a previous catheter had been inserted by the open technique and removed for dysfunction. Continuous ambulatory peritoneal dialysis was started at the end of the procedure. The mean operative time was 22 minutes in group A and 29 minutes in group B ($P < 0.001$). Fluid leakage was observed in eight patients in group A, but in no patients in group B ($P < 0.005$). Peritonitis occurred in five patients in group A and in three patients in group B ($P > 0.1$). Tip migration occurred in five patients in group A and no patients in group B ($P < 0.005$). In group B, two patients underwent a simultaneous cholecystectomy and one underwent incisional hernia repair. Laparoscopic placement of a Tenckhoff catheter leads to better function than does the open procedure; it allows immediate start of dialysis without fluid leakage and permits simultaneous performance of other laparoscopic procedures.
Key Words: Cholecystectomy—Continuous ambulatory peritoneal dialysis—Incisional hernia—Laparoscopy—Renal disease.

Continuous ambulatory peritoneal dialysis (CAPD) is an effective method of renal replacement therapy for patients with end-stage renal disease. Since the introduction of a suitable long-term indwelling catheter in 1968 (1), this device has gained widespread acceptance, thereby popularizing peritoneal dialysis as an acceptable alternative to hemodialysis (2).

Despite the increased use of the Tenckhoff catheter for CAPD and the standardization of surgical techniques, this device is still associated with a significant number of complications, such as peritonitis and outflow obstruction (2,3). Various techniques have been described for the placement of CAPD catheters. Traditionally, an open laparotomy technique has been used via a lower abdominal incision. Recently, laparoscopic guidance has been used to site the catheter under direct vision (4,5). Laparoscopy has also been used to salvage catheters that are dysfunctional because of omental adhesions and migration of the tip (2,6–9).

Until now, there have not been any prospective trials comparing which technique is best for the placement of Tenckhoff catheters. Therefore, we designed a prospective randomized clinical study to investigate the results

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of the laparoscopic versus open laparotomy technique in the placement of Tenckhoff catheters for CAPD.

MATERIALS AND METHODS

The study was approved by the Scientific Committee on Human Rights in Research of the G. Hatzikosta General Hospital, Ioannina, Greece. Adult patients undergoing insertion of a Tenckhoff catheter for CAPD gave their informed consent to participate in this study. Patients were excluded only if a problem for general anesthesia was found. Fifty patients were randomly assigned (a closed envelope contained information regarding placement into group A or B) to one of two groups of 25 patients each. Group A underwent an open laparotomy technique with local anesthesia. In 22 patients, the catheter was inserted through a 3- to 4-cm midline incision, and in 3 patients with histories of a previous catheterization, a small paramedian incision was used. No intraabdominal fixation of the catheter was performed. After the procedure, the patients were transported to the nephrology department. Continuous ambulatory peritoneal dialysis was started 24 to 48 hours later using small amounts of fluid, and several days later, the full program of CAPD was started. Group B underwent laparoscopic placement of the catheter. With general anesthesia, the patient was placed in a supine 30° Trendelenburg position. We inserted three 10-mm trocars; the first was inserted infraumbilically with a Hasson technique, the second was inserted suprapubicly, and the third was inserted at the left midcostal line between the iliac fossa and umbilicus. A fourth 5-mm trocar was inserted at the left iliac fossa (5). The laparoscope (0° or 30°) was placed through the infraumbilical port. A Tenckhoff catheter was introduced through the suprapubic port, which was then removed over the catheter, leaving the catheter to pass through the abdominal wall. The hole was sutured around the catheter on the inside cuff with an Endoclose needle (United States Surgical Corp., Norwalk, CT, USA) and nonabsorbable suture. Using the other two ports as working ports, we placed the catheter tip into the pelvis. The catheter was then secured to the back wall of the uterus in women or to the peritoneum overlying the back wall of the bladder in men, with 2/0 polypropylene laparoscopically placed sutures. The holes of the working ports were closed as the catheter hole with the Endoclose needle, using full-thickness nonabsorbable sutures, and the umbilical hole was sutured with open manner. A grasping forceps was placed through the wound of the midcostal working port and oriented to the suprapubic wound so as to create a subcutaneous tunnel for passage of the outer end of the catheter. This subcutaneous tunnel was continued between the two working ports so that the final exit of the outer end of the catheter was to be the port wound of the left iliac fossa. In 21 patients, this catheter was the first catheter inserted, whereas in 4 patients, a previous catheter inserted by open technique was removed (for dysfunction). In these four patients, the catheter placement was performed after laparoscopic lysis of adhesions. Immediately after the end of the procedure, the CAPD was started, and the patient was transported to the nephrology department to continue the CAPD program. Data were analyzed using the unpaired two-tailed t test and χ^2 analysis. Significance was defined as $P < 0.05$.

RESULTS

Demographic characteristics of patients were comparable for the two groups (Table 1). Six patients were excluded from the study because they developed severe cardiovascular or respiratory disease, which contraindicated general anesthesia; all of these patients were operated on using the open technique with local anesthesia.

The mean operative time was significantly lower in group A than in group B (Table 1). The difference in postoperative peritonitis was not statistically significant, whereas the fluid leaking and tip migration of the cath-

TABLE 1. *Demographic data and operative variables*

Parameter	Results by group		*P* value
	A	B	
Age (yr)	48–72 (mean, 62)	25–74 (mean, 58)	NS
Men/Women	16/4	18/7	NS
Mean operative time (min)	22 ± 5	29 ± 7	<0.001*
Fluid leaks (no. patients)	8	0	<0.005†
Peritonitis (no. patients)	5	3	>0.1†
Tip catheter migration (no. patients)	5	0	<0.005†
Removal of the catheter (no. patients)	3	1	>0.25†

* t test
† X^2 test.

eter had a significantly lower incidence in group B than in group A. In group A, three of five patients with peritonitis had their catheter removed after 6, 11, and 15 months postoperatively, respectively. In group B, one of three patients with peritonitis had the catheter removed 12 months later.

In group A, there were two coexisting diseases (cholelithiasis in one patient and a small inguinal hernia in one patient), but no simultaneous therapy was performed. In group B, there were three coexisting diseases (cholelithiasis in two patients and incisional hernia in one), and simultaneous cholecystectomies and a laparoscopic incisional hernia repair were performed. Additionally, five patients in group B who underwent previous laparotomies had an extended adhesiolysis performed before catheter placement. In group A, in three patients with a history of previous catheterization and in one patient with a previous midline laparotomy, a paramedian incision was used with adhesiolysis near the incision because the small laparotomy made extensive adhesiolysis impossible.

In both groups, the remaining catheters are functioning well (4–36 months; mean, 21 ±10), except for three patients in group A with diminished fluid return because of migration of the tip.

DISCUSSION

Peritoneal dialysis continues to gain popularity for treatment of patients with end-stage renal disease. Despite the widespread acceptance of CAPD, success is limited by the need for a functioning Tenckhoff catheter (2). In 1991, approximately 20% of the 4,300 patients who discontinued peritoneal dialysis did so because of catheter failure (10). Many reports describe the complications of CAPD as peritonitis, outflow obstruction, extraperitoneal placement of catheters, genital edema, hernias, dialysate leak, cuff extrusion, and respiratory compromise (2,3,11–14). The improvement of surgical technique in open surgery has decreased the incidence of these complications (3,11,15).

Laparoscopy has been reported in small series of patients for placement of Tenckhoff catheters for CAPD (5,16–18). In addition, some papers have described laparoscopic management of malfunctioning peritoneal dialysis catheters (2,19–21). These papers have shown that the laparoscopic approach is a useful addition to the surgical armamentarium for patients with malfunctioning CAPD catheters and that laparoscopic placement of the CAPD catheters has significant advantages over open techniques (5,22).

There were two distinct advantages to laparoscopic placement of CAPD catheters. First, suture fixation of the tip catheter prevents catheter migration. The incidence of catheter tip migration, resulting in poor return of dialysate, is significantly higher when the catheter has not been sutured into the pelvis (23). An open laparotomy technique can be used to enable suture fixation to overcome the problem of catheter migration. However, the associated pain and morbidity are significant because of the lower abdominal incision. The laparoscopic insertion of the Tenckhoff catheter reduces wound-related morbidity while still allowing suture fixation of the catheter tip. In the current study, catheter migration was prevented in all patients in the laparoscopic group, whereas in the open laparotomy group, this problem was observed in 20% of cases.

The second advantage of laparoscopic placement of CAPD catheters is that closure of the port wounds prevents fluid leaking so that the commencement of dialysis is started immediately. We believe that leakage was less significant in the laparoscopic group because the port wounds are significantly smaller than those resulting from small laparotomy in open surgery, which means that the closure is more water-tight for the laparoscopic than for the open laparotomy group.

The ability to perform simultaneous operative procedures during laparoscopic placement of CAPD catheters is essential. Avoidance of an incision and the reduction of surgical procedures are of vital significance for these high-risk patients. Laparoscopic hernioplasty is an easy procedure (24) and facilitates CAPD, whereas an open hernia repair can be accompanied by fluid leakage and is associated with a high incidence of recurrence. Therefore, we believe that for patients with coexisting surgical abdominal diseases who are in good condition for general anesthesia and in whom placement of a CAPD catheter is indicated, the laparoscopic approach is preferable. Conversely, in patients with contraindications to general anesthesia, the open technique with local anesthesia is the procedure of choice.

In the current study, no morbidity from general anesthesia was observed, but patients with problems contraindicating this type of anesthesia were excluded. Perhaps spinal anesthesia will minimize the anesthesia contraindications of the laparoscopic approach, but this type of anesthesia must be investigated for laparoscopic placement of CAPD catheters.

In conclusion, the laparoscopic placement of Tenckhoff catheters currently necessitates more operative time and general anesthesia, but it leads to accurate placement of the catheter tip with better catheter function, and it allows for immediate dialysis. Fluid leakage is

minimized, and other laparoscopic procedures can be performed simultaneously. Therefore, the laparoscopicapproach for placement of CAPD catheters is an excellent alternative to the open approach.

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