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Original Article

Comparative Outcome of Extra-Peritoneal Laparoscopic Technique with Open Technique for Continuous Ambulatory Peritoneal Dialysis

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Abstract

Background: **The common problems after performing continuous ambulatory peritoneal dialysis (CAPD) were catheter migration, leakage, outflow obstruction and hemorrhage. There was a study of comparison between laparoscopic and open technique complications the results of which were 13% and 35%, respectively. At present, there were many laparoscopic techniques to improve outcome due to minimally invasive nature and direct visual pathology. The extra-peritoneal method is a good option to reduce complication.**

Materials and Methods: **The retrospective cohort study was carried out to compare laparoscopic Tenckhoff insertion via extra-peritoneum and open technique. The patients' data were collected from January 2010 to January 2012. The operations were performed by two surgeons. Fifty nine patients were enrolled in this study but three were excluded so the total number was 56 patients. Outcomes at 6 months were analyzed. The survival of catheter was compared between two techniques. The statistical analysis was performed using a Chi-square test, Fisher's exact tests and t-test with *p*-value < 0.05 as statistical significance. The Kaplan-Meier survival analysis was used to compare survival rates.**

Results: **There was no difference in age and gender between two groups. Most patients had underlying hypertension or diabetes. The comparative data between laparoscopic and open methods in follow-up time (month), operative time (min) and number of catheter survival after 6 months (%) wer e21±3 vs 10±3, 45±12 vs 19±8 and 89% vs 66% respectively. The complication rates in term of migration, leakage, bleeding and peritonitis at the first 6 months between laparoscopic and open methods were 0% vs 21%, 0% vs 5%, 0% vs 5% and17% vs 18% respectively. Only the migration rate of catheter was significantly lower in the laparoscopic group compared with open technique. However, long-term catheter survival was not different.**

Conclusion: **The laparoscopic Tenckhoff insertion via extra-peritoneal approach is feasible and effective in reducing postoperative catheter complications especially catheter migration.**

Keywords: **Peritoneal dialysis, Continuous ambulatory peritoneal dialysis, Tenckhoff catheter,Llaparoscopic technique, Open technique**

Introduction

In modern surgery, laparoscopic surgery is preferred over open surgery due to its better outcome in term of pain, recovery and cosmetic. There were three options for continuous ambulatory peritoneal dialysis (CAPD): the open surgical technique, the trocar technique, and the laparoscopic technique[1]. The most common problem after performing CAPD was catheter migration. There were studies showing the incidence of catheter migration by comparison

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between open and laparoscopic techniques with the results of 16-54% and 9% respectively[2,3]. The second was a port site leakage which occurred in 4-12% of case[4,5]. In our hospital the catheter migration was at high rate similar to previous studies. Besides, the open or trocar technique had a risk of perforation, hemorrhage and outflow obstruction due to displacement of catheter tip or omental wrapping[8,9]. The laparoscopic approach could resolve these problems by direct visual feedback. There were many laparoscopic techniques developed using 2 or 3 port-site via intra-peritoneal approach. A new technique called pre-peritoneal tunneling method or extra-peritoneal approach has no leakage or outflow obstruction and can be used immediately for CAPD after completion of surgery[10]. Because we had experience with laparoscopic total extra-peritoneal hernioplasty (TEP), we thought that this pre-peritoneal tunneling method was feasible to perform. In the present study, we presented long-term outcome and catheter survival rate by comparing the two techniques.

Materials and Methods

This retrospective cohort study was performed after informed consent. The data were recorded from January 2010 to January 2012. Fifty nine patients with end-stage renal failure were enrolled in this study. There were two surgeons performing the Tenckhoff catheter insertion. One surgeon performed all the laparoscopic Tenckhoff catheter (TK) insertion in 21 patients and the other one performed open technique in 38 patients. The catheters' survival was calculated from the day of insertion to the date of shift mode dialysis. Only catheter removal related to mechanical or infectious complication was recorded. The patients who had severe co-morbidities, high risk for surgery, multiple surgeries, low midline surgery and removals for other reasons including transplantation, patient's decision, or death due to concurrent disease with a functioning catheter were excluded. We used a coiled Tenckhoff catheter placed in cul-de-sac for both techniques. Intravenous prophylaxis antibiotic was administrated 1 hr before starting operation and after operation until 24 hrs. We used cefazolin or vancomycin for the patients who had allergy to penicillin as a prophylactic antibiotic.

Surgical Techniques

After induction of general anesthesia and gastric decompression, the patient was placed in the Trendelenburg position. The pneumoperitoneum was established using a Veress needle placed at supra-umbilicus (Figure 1, 3). We preferred this site for a 5-mm camera 30° port to avoid internal organ injury and to have the catheter tunnel in midline. The abdomen was insufflated to 12-mmHg pressure, and a 5-mm port was introduced into intra-peritoneal cavity. The intra-

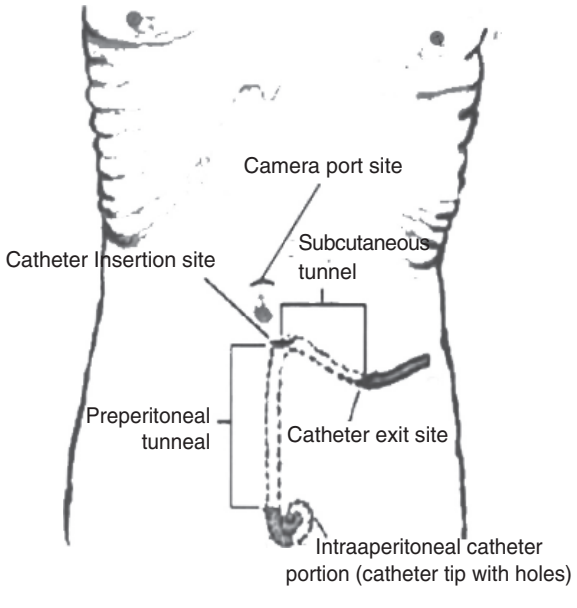

Figure 1 Demonstrated camera port and catheter exist site

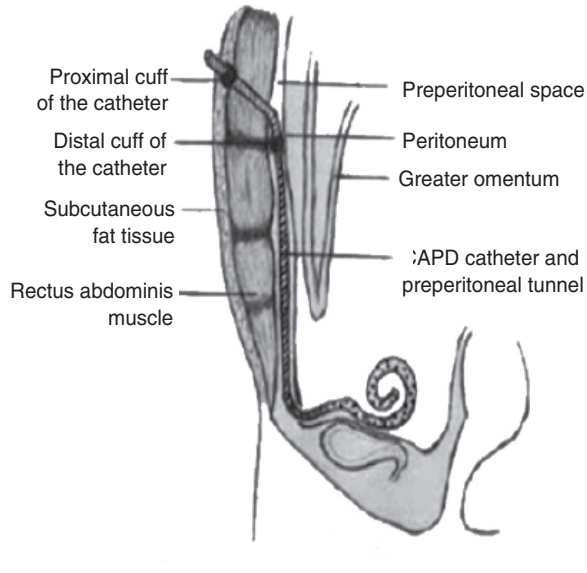

Figure 2 Demonstrated extra-peritoneal tunnel

Figure 3

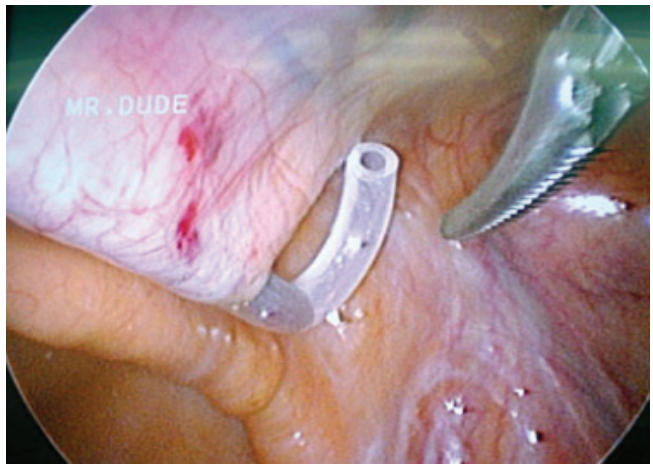

Figure 5

Figure 4

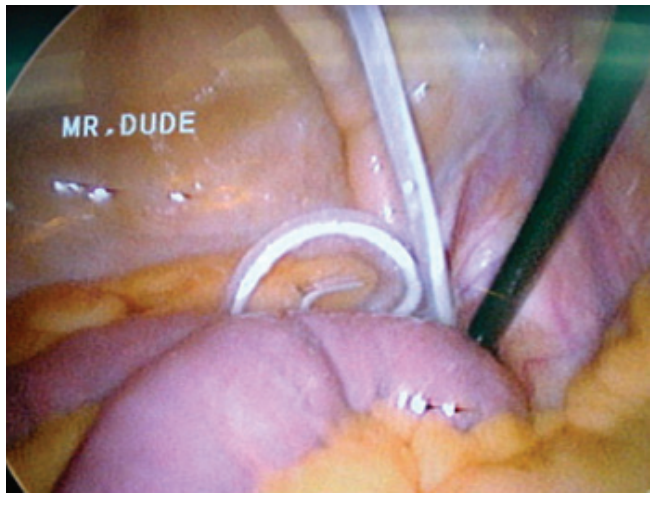

Figure 6

peritoneal pathology was evaluated with a 30° camera (Figure 4). A 5-mm incision was performed at right or left lower quadrant for exit site of catheter and this site was used for intra-peritoneal manipulations. Beneath the umbilicus around 5-7 cm, a 5-mm vertical skin incision was performed and skin and subcutaneous tissues were dissected with the Metzenbaum scissors until the anterior rectus fascia was seen. From this incision, a Tenckhoff peritoneal dialysis catheter was inserted with a metal guide wire until the tip of catheter was introduced into the pre-peritoneal space (Figure 2, 5, 6). Just above the superior border of urinary bladder, a 3-4 mm hole was made using electrocoagulation and the catheter was pushed over guide-wire into retrovesical pouch, then the guide wire was removed. The pneumo-peritoneum was deflated. All the fascial layers at port site were not sutured. The catheter exit site was performed by creating a subcutaneous tunnel from the last incision to the incision located in the right lower quadrant. Finally, all skin incisions were sutured. The peritoneal cavity was flushed with 2,000 ml of peritoneal dialysis solution to check for gross bleeding or leakage. Routine dialysis was started after 14 days.

Open Technique

In our hospital, open operation is the standard procedure for all patients and local anesthesia is the preferred option. A right or left paramedian incision size 0.5 cm was made approximately halfway along a line from the anterior superior iliac spine to the umbilicus. A 2-3 cm midline incision was performed

below umbilicus but located at the same level of exit site. Using a stiff wire as guidance, the tip of the catheter was pushed into the pelvic cavity but did not reach the deep cul-de-sac. The first Dacron cuff stayed above pre-peritoneum but beneath the rectus muscle then the purse string suture was performed around the catheter and the second cuff was located 2-3 cm from the exit site. Free flow of saline was checked into and out of the peritoneum. The catheter was brought through a subcutaneous tunnel to the previously chosen exit site. Heparin was instilled into the catheter. Finally, the rectus sheath was closed with vicryl 3/0, and the skin was sutured with interrupted nylon 4/0. Routine dialysis was started after 14 days.

Definition of Complications

The mechanical complications during the first six months were classified as bleeding, early dialysate leakage, omental wrapping, catheter migration and incisional hernia. The infectious complications were evaluated as peritonitis, exit-site infection, and tunnel infection. Peritonitis was diagnosed when two of the following criteria were fulfilled: abdominal pain, cloudy dialysate and leukocytes >100/mm^3 with>50% polymorphonuclear cells, or positive dialysate culture[13]. Exit-site infection was defined as erythema with or without skin induration or purulent discharge from the exit site.

Statistical analysis

Chi-square analysis and Fisher's exact tests were used for analysis of categorical variables. The t-test was used for continuous variables. Kaplan-Meier survival analysis was computed for both groups and log rank test was used for statistical analysis. A *p*-value less than 0.05 was considered significant.

RESULTS

Fifty nine patients were enrolled in this study but three from laparoscopic group were excluded due to loss to follow-up and death from other unrelated catheter complication. There were no differences in age and gender between two groups. Most of patients had hypertension, diabetes or other causes of chronic kidney disease. In Table 1, the operative time was significantly different between two techniques ($p<0.00$) with longer operative time in the laparoscopic group.

Table 1 Characteristics of patients of laparoscopic versus open group.

Variable	Laparoscopic group (n=18)	Open group (n=38)	*p*-value
Age (yrs)	**57 ± 1 5**	**51 ± 14**	**0.27**
Gender			
- Male	7 (39%)	18 (47%)	0.58
- Female	11 (52%)	20 (53%)	
Previous abdominal surgery	2 (9.5%)	-	-
Operative time (min)	45 ± 12	19 ± 8	0.00
Time of follow up (month)	21 ± 3	10 ± 3	-
Catheter survival after 6 months	16 (89%)	25 (66%)	0.00

Table 2 Complications of laparoscopic and open technique at first six months

Variable	Laparoscopic group (n=18)	Open group (n=38)	p-value
Migration	-	8 (21%)	0.04
Fluid leakage	-	2 (5%)	1.00
Bleeding	-	2 (5%)	1.00
Incisional hernia	-	-	-
Exit site infection	-	-	-
Peritonitis	3 (17%)	7 (18%)	0.34
Organ injury	-	-	-

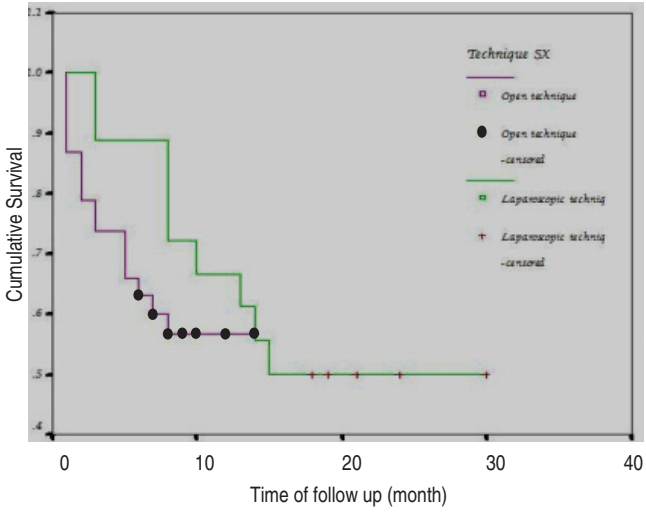

Figure 7

Because there were two previous surgery cases that we performed adhesiolysis together with laparoscopic TK insertion so the operative time was prolonged to 60 min. The adhesion was from previous infertility surgery and appendectomy. In our first three cases the average time for surgery was 55-60 min due to early experience. However, the catheter survival after six months in laparoscopic group was significantly better than open technique group ($p< 0.00$).

Complications six months after surgery showed that the rate of catheter migration was significantly higher in the open technique than those in the laparoscopic technique ($p< 0.04$) and peritonitis was a main cause of complication in the laparoscopic group (Table 2). There were two cases with leakage (5%) and two cases with bleeding (5%) in the open technique group. The other complications such as incisional hernia, exit site infection or organ injury did not occur in both techniques.

The catheter survival was not different between two groups (χ^2 0.98, log-rank test = 1; $p<0.32$) (Figure 7). The number of survival catheter by laparoscopic and open technique after 6 months was 16 (89%) vs 14 (63%) and after 12 months was 12 (67%) vs 22 (58%) respectively. The catheter survival was decreased in both techniques due to the fact that most patients had a migration or peritonitis that needed catheter removal.

Discussion

The present study demonstrated the potential of laparoscopic extraperitoneal TK insertion to be superior than open technique at the first 6-month complications especially the catheter migration[6,11,12]. At our hospital, the TK catheter insertion was performed by general surgeon or nephrologistin which the most common problem was displacement of catheter which caused catheter dysfunction. So we wanted to resolve this problem with more effective technique using laparoscopic approach with an experience from laparoscopic herniorhaphy. The outflow obstruction due to catheter tip migration or omental wrapping can be resolved with the laparoscopic TK insertion via extra-peritoneal route using pre-peritoneal fixation[10]. Although the long term catheter survival was not different between two groups, the laparoscopic TK insertion which the TK catheter was fixed at anterior abdominal wall by non-absorbable suture. There were three studies that reported fixing the catheter tip to the pelvis with non-absorbable sutures to prevent catheter migration[6,11,12] but this procedure might create a catheter loop with a potential risk for mechanical intestinal obstruction by herniated small bowel between catheter and abdominal wall. On the other hand, if the catheter needed to be removed for any reason, an additional intra-peritoneal operation might be required[10]. The laparoscopic extra-peritoneal approach can solve this problem due to its easiness to remove. Other advantage of laparoscopic approach is an ability to see intra-peritoneal pathology and to manage simultaneous surgery such as adhesiolysis in previous abdominal surgery, myoma uteri, ovarian tumor and finally laparoscopic TK via extra-peritoneal approach that may be performed together with laparoscopic total extra-peritoneal herniorrhaphy (TEP) in inguinal hernia[7]. The disadvantage of this technique is a need for general anesthesia whereas the open technique does not require. The leakage of the dialysis fluid is another early complication of CAPD and it results in the interruption of routine peritoneal dialysis. It is generally recommended that the catheter should not be used for peritoneal dialysis 14-21 days after the operation[10]. Our method uses only two 5-mm trocars, and the catheters were inserted into the peritoneal cavity after being passed through a pre-peritoneal tunnel. Thus, most of the catheters were fixed extra-peritoneal by this tunnel without sutures as shown in Figure 2. It is interesting that this extra-peritoneal approach is effective in preventing catheter migration and reduces leakage similar to previous

report[13]. The peritonitis may cause reduced survival catheter rate so it needs intensive care and close surveillance. In one study performing open technique[14] showed migration (6%), leakage (6%), bleeding (6%), organ injury (0%) and peritonitis (3%). In the open technique if Tenckhoff catheter was passed through the abdominal midline, there was a risk for incisional hernia although this did not occur in our study. Finally, we compared our extra-peritoneal versus intra-peritoneal laparoscopic approach, Soontrapornchai P et al[12] that the complications result were migration (0%; 0%), leakage (0%; 2%), bleeding (0%; 2%), incisional hernia (0%; 6%), exit site infection (0%; 6%) and peritonitis (17%; 32%), respectively which demonstrated superiority of our technique.

The laparoscopic extra-peritoneal method has a very low risk for leakage so peritoneal dialysis could be started on the first day after operation[10] but we usually start at day 14-21.

Conclusion

The laparoscopic extra-peritoneal approach for TK insertion is feasible and effective in reducing catheter complications especially catheter migration when compared with the open technique. The advantages are ability to perform adhesiolysis, direct visualize while putting the catheter in correct position and look for other abnormal pathologies in abdominal cavity.

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