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Original Article

Laparoscopic Salvage of Malfunctional Peritoneal Dialysis Catheters. Outcome and Patency in 37 Patients

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Abstract

Background: There are more than 100,000 patients in Thailand who require long-term renal replacement therapy, and the number continues to grow significantly. Peritoneal dialysis is a viable option with some advantages over hemodialysis. However, malfunction of peritoneal dialysis catheters is the major problem in these patients. Laparoscopic salvage of the catheters can resolve the major cause of malfunction.

Objective: To evaluate the success rate and safety of laparoscopic salvage of malfunctioning peritoneal dialysis catheters and the patency of salvaged catheters in Suratthani Hospital.

Methods: In this retrospective descriptive study, 42 patients who underwent laparoscopic salvage of malfunctioning peritoneal dialysis catheters at Suratthani Hospital were included. All the salvage procedures were performed under general anesthesia using one 10 mm and two 5 mm ports. The various techniques to rescue catheter function included re-positioning the catheter with pelvic fixation, clearing the fibrin clot/sheath, freeing up the omental, adhesion, and partial omentectomy. All patients were followed up for at least 6 months or until using peritoneal dialysis discontinuing.

Results: A total of 42 laparoscopic salvage of catheter malfunctions were attempted and succeeded in 37 cases. The mean operative time was 62.4 minutes. The omental wrapping was the most common cause of catheter malfunction (62.1%). The catheter patency rate was 83.7%, 62.1%, 45.94%, and 24.32% at 1 month, 6 months, 12 months, and 24 months respectively.

Conclusion: Laparoscopic salvage of malfunctioning peritoneal dialysis catheters seems feasible and safe to recuse and prolong peritoneal dialysis catheter usage. Our findings will provide insight for surgeons in salvaging peritoneal dialysis catheter malfunction.

Keywords: Peritoneal dialysis, Laparoscopy, Salvage, Patency

Introduction

There are currently over 100,000 chronic kidney disease patients in Thailand who require long-term renal replacement therapy, and the number continues to grow significantly.[1] Since 1976, peritoneal dialysis has been a viable option for patients with end-stage renal disease[2] with some advantages over hemodialysis, including cost, convenience, patient independence, and improved nutrition.[3] But infection and mechanical malfunction are the major problems of peritoneal dialysis catheters.[3]

The catheter malfunctions are mostly caused by catheter tip migration, omental wrapping, or adhesion.[4-5] Several techniques, including open revision, fluoroscopic-guided manipulation, and laparoscopy, have been used to salvage malfunctioning catheters.[6] The success rate is highly variable between procedures as well as operators.[7-12]

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Laparoscopic salvage of malfunctional peritoneal dialysis catheters with Pelvic Fixation and omentectomy can resolve major malfunction causes.[10-11] This paper describes our surgical technique and treatment outcome.

Material and Methods

This was a retrospective descriptive study including all the patients who had peritoneal dialysis catheter placement malfunction at Suratthani Hospital from 1 January 2017 to 31 December 2020. All patients previously had open peritoneal dialysis catheter placement, and a nephrologist detected the problems. Then, all patients underwent typical conservative treatment such as irrigation, laxatives, thrombolysis agents, etc.

All patients had laparoscopic salvage of malfunctioning peritoneal dialysis catheters under general anesthesia. We created pneumoperitoneum via a previously placed peritoneal dialysis catheter. A 10-millimeter port was placed at the supraumbilical area, and two 5-millimeter ports were placed at the left lower quadrant and the left para-umbilical areas (Figure 1). After identifying and freeing the catheter, we removed and cleaned all the tissue trapped in the catheter (Figure 2). The catheter was fixed to the pelvic peritoneum with Vicryl 3-0 via Carter-Thomason needle. Omentectomy was performed with an energy-sealing device and removed via an umbilical port (Figure 3).

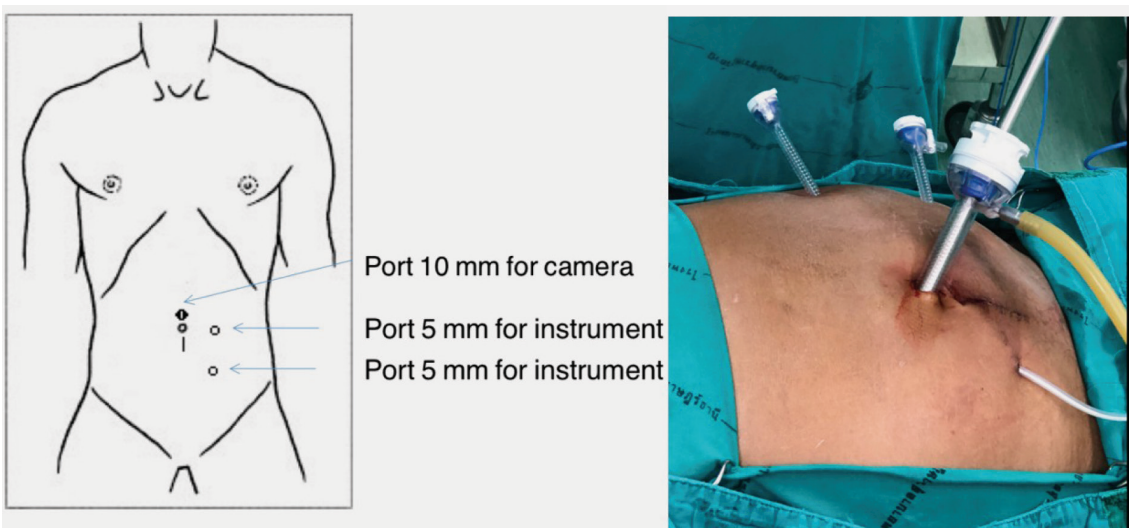

Figure 1 Ports placement

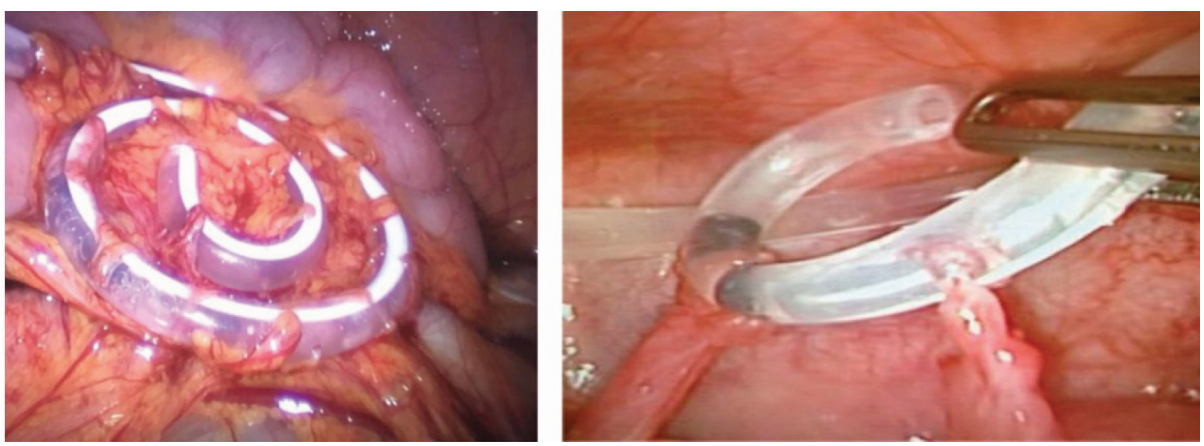

Figure 2 All tissue trapped in the catheter was removed and cleaned

Figure 3 Partial omentectomy

The study was approved by the Clinical Research Ethics Committee of the Suratthani Hospital. The minimum number of required participants was 16 cases to demonstrate the patency of the catheter from the sample size calculation for one sample, a continuous outcome with the patency data from Santarelli et al. study.[10]

All patients were followed up for at least 6 months unless peritoneal dialysis was stopped. We reviewed demographic details of the patients, etiology, and causes of catheter malfunction through medical records. Maneuvers for salvage, operative time, length of stay, and complications were also retrieved. STATA 13.0 was used to analyze. Categorical data were presented as percentages and continuous data as mean ± SD or median [interquartile range (IQR)] as appropriate. Kaplan-Meier curves were generated to demonstrate Catheter patency over observed time.

Results

We attempted to salvage peritoneal dialysis catheter malfunction in 42 patients surgically. Five patients did not receive revision due to intraabdominal infection (2 patients) or severe intraabdominal adhesion (3 patients). Overall, 37 laparoscopic salvage of catheter malfunctions were performed. The demographics and characteristics of the patients are shown in Table 1. For the entire population, the mean age was 60 years (SD 13.4). Most of the patients (97.2%) had hypertension, and half of the patients (51.3%) had diabetes mellitus, followed by gout (24.3%), cardiovascular disease (18.9%) and cerebrovascular disease (16.2%). All the patients had previously undergone opened peritoneal dialysis catheter placement from a median of 62 days (IQR 11-593) ago, and 12 patients (32.4%) had previous other abdominal surgery.

The mean operative time was 62.4 minutes. The omental wrapping was the most common cause of catheter malfunction in 23 cases (62.1%). Other etiologies were catheter malposition in 8 cases (21.6%) and fibrin plug/sheath as well as other adhesion in 6 cases (16.2%). Five patients had 30-day-postoperative complications, including 2 cases with bleeding, 2 cases with surgical site wound infection, and one death from ischemic heart disease. The median catheter patency was 184 days (IQR 36-568). The catheter patency was depicted with the Kaplan-Meier curve in Figure 4. One-month catheter patency was 83.7%. The catheter patency rate was 62.1%, 45.94%, and 24.32% at 6 months, 12 months, and 24 months, respectively. The most common reason to abandon peritoneal dialysis was catheter infection (32.4%), followed by death (18.9%), malfunction (13.5%), and bleeding (2.7%).

Table 1 Patient demographic data and result

Characteristics	(N, %)
Age (years): mean (SD)	60 (13.4)
Sex	
Male	22 (59.4)
Female	15 (40.5)
Underlying disease	
Diabetic mellitus	19 (51.3)
Hypertension	36 (97.2)
Gout	9 (24.3)
Adult polycystic kidney disease	1 (2.7)
Cerebral vascular disease	6 (16.2)
Cardiovascular disease	7 (18.9)
Time of previous catheter placement (days): median (IQR)	62 (11 - 593)
Previous other abdominal surgery	12 (32.4)
Operative time (minutes): mean (range)	62.02 (20-110)
Primary ethology of dysfunction	
Omental wrapping	23 (62.1)
Catheter malposition	8 (21.6)
Fibrin plug and other adhesion	6 (16.2)
30-day postoperative complication	5 (13.5)
Bleeding	2 (5.4)
Surgical site wound infection	2 (5.4)
Death	1 (2.7)
Catheter patency (days): mean (Median) (IQR)	184 (36 - 568)
Patency rate (n, %)	
At 1 month	31 (83.7)
At 6 months	23 (62.1)
At 12 months	17 (45.94)
At 24 months	9 (24.32)
Overall peritoneal dialysis abandon (n, %)	24 (64.8)
Infected catheter	12 (32.4)
Death	7 (18.9)
Malfunction catheter	5 (13.5)
Bleeding	1 (2.7)

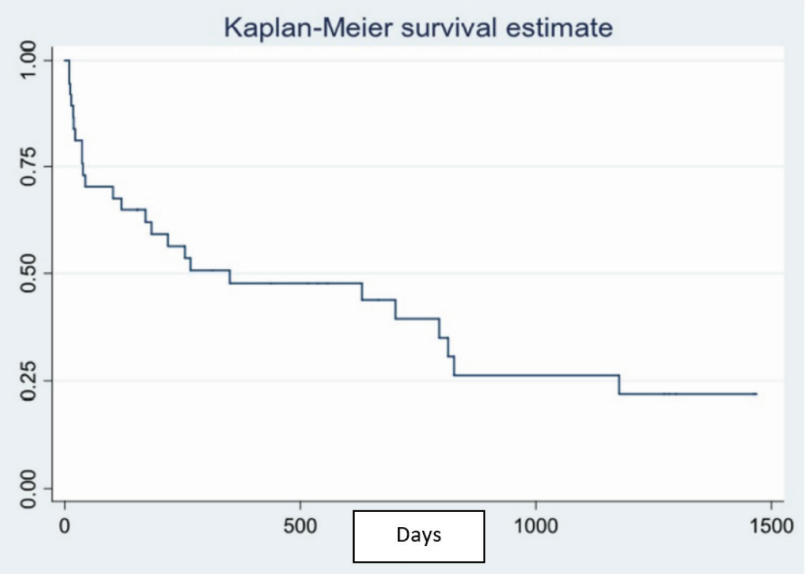

Figure 4 Survival of the peritoneal dialysis catheter

Discussion

Currently, about half of long-term renal replacement therapy in Thailand is peritoneal dialysis.[1] It has some advantages over hemodialysis, including fewer hospital visits and fewer dietary restrictions. The catheter mechanical malfunction is the second most common reason to remove the catheter behind the infection.[4] Instead of the catheter's removal, salvage of the catheter can rescue and prolong the catheter's life. Recently, various procedures have been used to salvage the catheter, including fluoroscopy-guided manipulation, open revision, and laparoscopic revision. The advantage of laparoscopic salvage over other methods is direct visualization and correction of the malfunction's cause.

The most common cause of malfunction in our study is omental wrapping (62.1%). We use sharp dissection with scissors and blunt dissection to strip the omentum from the catheter. Campisi S et al. have described a technique of partial omentectomy at laparoscopy,[13] and we prefer to perform partial omentectomy with an energy-sealing device to prevent the recurrent omental wrapping. Other researchers have described omental folding[11] or complete omentectomy[14] to prevent recurrent omental wrapping, although no data compares those techniques.

Catheter malposition is another common cause of catheter malfunction. It occurred in 8 patients (21.6%) in our study. To prevent malposition, Kumar et al.[15] and Bae et al.[16] described a technique of fixing the catheter to the lower abdominal wall with a suture. Our preference is to perform catheter fixing with the lower abdominal wall in all patients who require salvage of a malfunctioning CAPD catheter.

This study shows the success rate and safety of laparoscopic salvage of catheters. The procedure can prolong catheter life by a median of 184 days with 1-month and 6-month catheter survival rates at 83.7% and 62.1%, respectively, compared favorably to previous studies.[9-11,17] Despite good short-term outcomes, only one-quarter of salvaged catheters survived until 2 years. The survival of salvaged catheters is significantly lower than the new case of peritoneal catheter placement, with a 2-year survival of about 60-80%.[6,10,13]

Our study has some limitations. The study is a retrospective study from a single medical center, which is subjected to selection bias and missing variables. The number of patients is small compared to overall peritoneal dialysis patients. A large prospective study should be done in the future.

Conclusion

We found that most peritoneal dialysis catheter malfunction was caused by omental wrapping and catheter malposition. Laparoscopic salvage of malfunctioning peritoneal dialysis catheters was feasible and relatively safe in most patients. The operation could prolong catheter usage temporarily. However, the long-term catheter patency rate is still unsatisfactory. Newer surgical techniques to prevent recurrent catheter malfunction are warranted.

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