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CASE REPORT

Laparoscopic-assisted catheter insertion for continuous ambulatory peritoneal dialysis: A case report of simple technique for optimal placement

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Abstract

A 40-year-old male underwent tube placement surgery for continuous ambulatory peritoneal dialysis (CAPD). A 2-cm skin incision was made, and the peritoneum was reflected enough to perform secure fixation. A swan-necked, double-felted silicone CAPD catheter was inserted, and the felt cuff was sutured to the peritoneum to avoid postoperative leakage. An adequate gradient for tube fixation to the abdominal wall was confirmed. The CAPD tube was passed through a subcutaneous tunnel. Aeroperitoneum was induced to confirm that there was no air leakage from the sites of CAPD insertion. Two trocars were placed, and we confirmed that the CAPD tube led to the rectovesical pouch. Tip position was reliably observed laparoscopically. Optimal patency of the CAPD tube was confirmed during surgery. Placement of CAPD catheters by laparoscopic-assisted surgery has clear advantages in simplicity, safety, flexibility, and certainty. Laparoscopic technique should be considered the first choice for CAPD tube insertion.

Key words: Continuous ambulatory peritoneal dialysis; Dialysis catheter; Tube insertion; Surgical technique

Core tip: Continuous ambulatory peritoneal dialysis (CAPD) is currently considered the preferred choice for dialytic treatment, based on improved quality of life and patient survival. The open surgical technique for tube placement is easy, though a painful large incision is needed and unexpected tube dislocation may occur. Minimally invasive technique and optimal tube position should be guaranteed in the placement of CAPD catheters. We suggested that placement of CAPD catheters by laparoscopic-assisted surgery has clear advantages in simplicity, safety, flexibility, and certainty. Here, we present our surgical procedures and discuss key techniques and pitfalls with literature review.

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INTRODUCTION

Peritoneal dialysis (PD) is considered the first choice for dialytic treatment because it offers improved quality of life and patient survival compared with hemodialysis. PD, including continuous ambulatory peritoneal dialysis

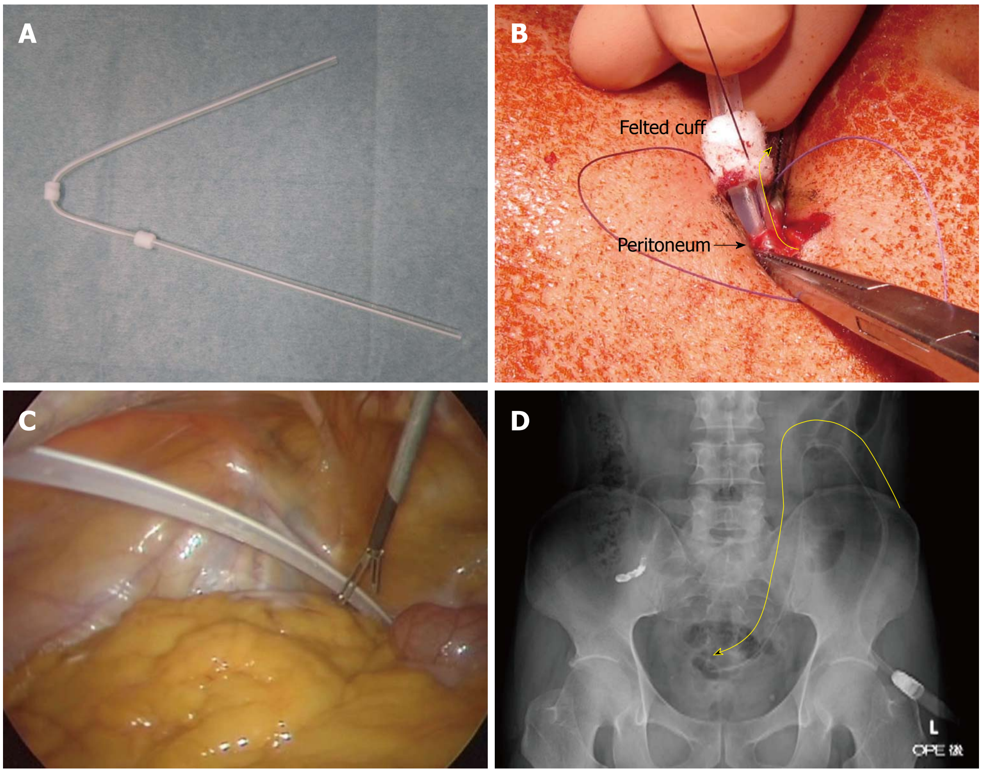

Figure 1 Actual material and surgical procedures. A: Double-felted swan-neck silicone catheter; B: Tube fixation to peritoneum. Peritoneum was reflected enough to make a secure fixation. A tight running suture was placed between the peritoneum and the felt cuff (yellow arrow); C: Laparoscopic view for tube placement. The catheter has been adequately directed by the fixation to the abdominal wall. The laparoscopic view confirmed that the catheter led to the rectovesical pouch; D: Intra-operative radiograph. Optimal and reasonable curve of catheter without any distortions was confirmed (yellow arrow).

(CAPD), is widely used in the treatment of end-stage renal failure[1-3]. The most frequent complications of PD are peritonitis[4-6], infection of the catheter exit site[7-9], mechanical complications[2,10,11], and dialysate leakage[12-14].

CAPD catheter insertion by the open method is easy, though a painful large incision is needed and unexpected tube dislocation may occur. With open surgery, minimally invasive technique and optimal tube position should be assured. Recent surgical innovations and technological improvements have been made, mainly in laparoscopic and laparoscopic-assisted surgery and advanced devices[2,10,11,13,15-19]. We present a case of laparoscopic-assisted catheter placement for CAPD induction in detail, and discuss key techniques and pitfalls for this minimally-invasive surgery.

CASE REPORT

A 40-year-old male suffered from renal failure due to immunoglobulin a nephropathy, and CAPD was introduced using a swan-necked, double-felted silicone catheter (JB-5; JMS Co. Ltd., Osaka, Japan; Figure 1A). Site marking was performed before surgery. After induction of general anesthesia, a urethral catheter was inserted to avoid bladder injury during surgery. A 2-cm skin incision was made, and the peritoneum was opened at the most caudal point to insert the CAPD tube (Figure 2). The abdominal wall was lifted with Kocher's forceps, and a 5-mm trocar for a camera was placed opposite the site of subcutaneous tube fixation after confirmation of intra-peritoneal adhesion (Figure 2). The peritoneum was reflected enough to perform secure fixation. The CAPD tube was inserted, and the felt cuff was sutured to the peritoneum with a tight running pattern to avoid postoperative leakage, using absorbable, atraumatic suture material (Figure 1B). The CAPD tube passed under the fascia, and the fascia was tightly closed from the caudal end with interrupted sutures. Hence the CAPD tube passed through the fascia at the most cranial aspect (Figure 2). An adequate gradient for tube fixation to the abdominal wall for a well-orientated catheter was confirmed. Subcutaneous tunneling was performed to accommodate the shape of the swan neck. The CAPD tube was passed through this tunnel, and the second felt was placed subcutaneously (Figure 2). Buried absorbable sutures were used for skin closure.

Aeroperitoneum was induced to confirm that there was no air leakage from the sites of CAPD insertion. A 5-mm laparoscope was inserted. No adhesions or ascites were observed. A 3-mm trocar was placed in the lower abdominal wall near the pubic bone as a working port, without bladder injury. The catheter had already been directed by the fixation to the abdominal wall. The CAPD tube was grasped with 3-mm laparoscopic forceps (Figure 1C). We confirmed by laparoscopy that the CAPD tube led to the rectovesical pouch (Figure 1C), and no stylet was required for tube placement. Tip position was

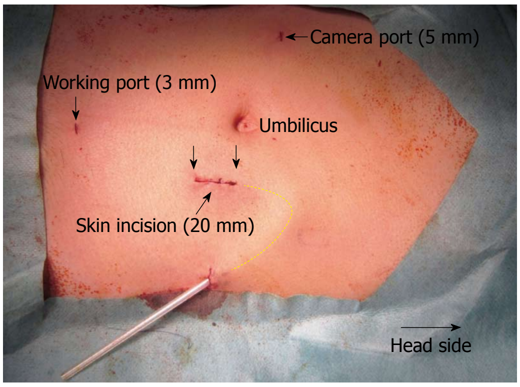

Figure 2 Findings after surgery. A 2-cm skin incision was made. Peritoneum was opened at the most caudal point to allow catheter insertion (red arrow). The catheter passed under the fascia, and then the fascia was tightly closed with interrupted sutures from the caudal side. Hence, the catheter passed through the fascia at the most cranial aspect (blue arrow). Note that the intentional discrepancy between the preperitoneal fixation points at the peritoneum (red arrow) and fascia (blue arrow) allowed proper orientation of the catheter through the abdominal wall. Two trocars (5 and 3 mm) were placed. Subcutaneous tunneling was performed, and the catheter was passed through the tunnel (yellow dotted line).

reliably observed laparoscopically. Enough carbon dioxide gas was removed from the trocar wound to prevent iatrogenic eosinophilic peritonitis, and the stab wounds for trocar placement were closed with buried absorbable sutures. The CAPD tube had a radiodense line, and intraoperative radiographs revealed optimal and reasonable curve of the CAPD tube (Figure 1D). Intentional discrepancy between the preperitoneal fixation points in the peritoneum and fascia as described above resulted in an adequate curve without any distortions (Figure 1D). Optimal patency of the CAPD tube should be confirmed during surgery. Normal saline (100 mL) was injected through the CAPD tube, and then a total of 79 mL was retrieved (79% retrieval rate). Total operative time for all procedures was 45 min.

The patient received a second-generation cephem antibiotic intravenously until postoperative day 3, and the postoperative course was uneventful. CAPD was introduced during the early postoperative period without obstruction, leakage, or infection.

DISCUSSION

PD including CAPD is currently considered the preferred choice for dialytic treatment, based on improved quality of life and patient survival. The open surgical technique for tube placement is easy, though a painful large incision is needed and unexpected tube dislocation may occur. Minimally invasive technique and optimal tube position should be guaranteed in the placement of CAPD catheters, and many physicians have established excellent laparoscopic techniques and advanced devices[2,10,11,13,15-19]. Patients in renal failure may have concurrent peritonitis, and peritonitis can also occur after CAPD induction[20-22]. In patients with mild ascites, sampling for culture or neutrophil counts is very easy with laparoscopy. Even though CAPD tubes are specially-designed devices, an artificial catheter is a foreign body. We suggest that bacteriological and microbiological assessments should be routinely performed during laparoscopic surgery if mild ascites is present.

Complications of CAPD include peritonitis, infection of the catheter exit site, mechanical obstruction, and dialysate leakage[2,4-14]. Many surgeons have previously demonstrated that laparoscopic surgery reduced these complications[2,10,11,15,17,23]. Omental wrap or plugging is one cause of mechanical obstruction[24,25]. Fibroadhesion and sclerosing peritonitis also decrease tube efficiency[26,27]. These mechanical obstructions require omentopexy, omentectomy, and other additional surgeries[22,23]. So-called "abdominal cocoon syndrome" can result in death and requires removal or reinsertion of the catheter[26,27]. Laparoscopic surgery has the advantage of flexible catheter placement according to intra-abdominal findings to prevent these complications[16].

Laparoscopic surgery results in less pain, shortened convalescence, improved cosmesis, and absence of wound complications[15,19,28]. A simple question arises: Is pure laparoscopic surgery better than laparoscopically-assisted surgery? Pure laparoscopic surgery has been documented to be an ideal technique for the placement of CAPD catheters[10,19]. Reports suggest that pure laparoscopic surgery has the advantage of preventing major complications in CAPD[10,19]. We agree that laparoscopic surgery offers many advantages in CAPD tube placement, but suggest that pure laparoscopic surgery requires more advanced techniques and involves technical difficulties because of the tangential view and access, especially in securely fixing the catheter to the peritoneum. We agree that pure laparoscopic surgery is ideal, but only in the hands of experienced surgeons. Laparoscopic surgery using single and two-port methods have been reported[17,18]. We employed two ports because it allowed greater flexibility for intraoperative procedures and required only a negligible second stab wound for a 3-mm port.

It has been reported that a pure laparoscopic intraperitoneal approach has the advantage of ensuring adequate insertion, which prevents mechanical obstruction and allows secure fixation to the peritoneum, preventing intractable leakage[10]. However, we found a 2-cm incision to be large enough for an optimal lead and secure catheter fixation. Mechanical obstruction[2,10,11] and dialysate leakage[12-14] are still the most serious complications in CAPD, and reasonable tube placement with secure fixation to the peritoneum are extremely important during surgery. We performed laparoscopic-assisted surgery with a minimally open method to create an adequate preperitoneal tube curve with secure fixation to the peritoneum. An adequate gradient for tube fixation to the abdominal wall can be made even with a 2-cm incision.

Image studies are important in CAPD tube placement[12,29]. Intraoperative radiographs revealed that our intentional discrepancy between the peritoneal and fascial fixation points worked well to create an optimal tube curve without any distortions and with a secure tip position.

Placement of CAPD catheters by laparoscopic-assisted surgery has clear advantages for simplicity, safety, flexibility, and certainty. Laparoscopic technique should be considered the first choice for CAPD tube insertion. In conclusion, laparoscopic approach is a very useful tool in the induction of PD programs.

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