A NEW SIMPLIFIED ONE-PORT LAPAROSCOPIC TECHNIQUE FOR PERITONEAL DIALYSIS CATHETER PLACEMENT

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♦ **Background:** Various techniques for laparoscopic insertion of a peritoneal dialysis catheter have been described. Usually 2–3 ports are required, and complications related to the port sites (such as abdominal wall hernia, leakage, and hemorrhage) cannot be avoided. To minimize the potential complications, we designed a simplified 1-port laparoscopic technique for peritoneal dialysis catheter placement.

♦ **Methods:** We conducted a retrospective data review of 44 patients who underwent 1-port laparoscopic insertion of a Tenckhoff catheter from June 2009 to February 2011. All patient data, including postoperative complications, were analyzed.

♦ **Results:** The mean follow-up period was 11.52 months. All catheters were working properly, except in 1 patient who developed peritonitis 3 months after catheter placement. (The catheter was removed.) No postoperative abdominal wall hemorrhage, early leaks, hernias, or catheter migration occurred. No exit-site or tunnel infections were observed.

♦ **Conclusions:** Our 1-port laparoscopic technique provides excellent catheter fixation, avoids excessive port sites, and yields good cosmesis. The low complication rate and the simplicity of the method justify its standard use for Tenckhoff catheter placement.

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The latest report from the US Renal Data System shows that the United States, Taiwan, and Japan continue to have some of the highest incidence rates of end-stage renal disease (ESRD): 371, 347, and 287 per million population respectively in 2009. In Taiwan, the prevalence of ESRD reached 2447 per million in 2009, and rates of 2205 and 1811 per million have been reported in Japan and the United States.

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Peritoneal dialysis (PD), a successful form of renal replacement therapy, has become more common as the prevalence of ESRD increases and the number of available donor kidneys fails to meet demand (1). Since continuous ambulatory PD (CAPD) was first introduced by Robert Popovich and Jack Moncrief in 1976, its application has continued to increase.

Three different methods for insertion of the PD catheter have been developed: the open surgical technique, the percutaneous needle-guidewire technique, and the laparoscopic technique (2,3). According to the 2010 guidelines of International Society for Peritoneal Dialysis, there is no evidence to support one method of insertion over another; however, the method used needs to be determined by patient characteristics (3,4).

Traditionally, peritoneal catheters have been placed by an open laparotomy technique. Recent advances in minimally invasive surgery have improved the safety and feasibility of laparoscopic peritoneal catheter placement (5). The superiority of the laparoscopic approach was reported to be shorter operating time, less postoperative pain, and fewer complications (6–12). Most of the recently developed laparoscopic techniques require 2–3 ports, with or without catheter fixation and omentum removal (13–16). However, each port creates a weak abdominal site where a hernia or future leakage might develop. We therefore developed a new laparoscopic technique that minimizes potential complications by using only 1 port.

METHODS

We retrospectively reviewed all patients undergoing 1-port CAPD catheter placement at Kaohsiung Chang Gung Memorial Hospital from June 2009 through January 2011. The nephrology department referred 44 patients who were considered eligible for PD. Patients who had previously undergone major abdominal operations were not eligible. All operations were performed by one experienced laparoscopic surgeon (SYL).

OPERATIVE TECHNIQUE

After induction of general anesthesia, the patient was placed in a supine position. Prophylactic antibiotics were routinely administered before the operation started.

Through a horizontal infraumbilical incision, a 7-cm midline subcutaneous tunnel was made using a Kelly clamp. The tunnel was created between the skin and midline fascia, with the 7-cm length being equal to the distance between the peritoneal cuff and the first side hole of the straight Tenckhoff catheter. Through the tunnel, a 5-mm bladed port was then carefully inserted into the abdomen to create pneumoperitoneum (Figure 1). Once pneumoperitoneum was established, with the pressure set at 12 – 15 mmHg, the laparoscope (5 mm, 0 degrees: Karl Storz, Tuttlingen, Germany) was inserted. The entire abdomen was examined to avoid any adhesions between the midline abdomen and bowel during Tenckhoff catheter insertion. If adhesions severe enough to require adhesiolysis were present, a 3-mm port was inserted at the estimated catheter exit site to facilitate dissection. Under direct visualization, the 5-mm port was directed toward the Douglas pouch. The laparoscope was then withdrawn from the 5-mm port before a guiding stylet was inserted. Using the guiding stylet pointed toward the Douglas pouch, a 41-cm straight Tenckhoff catheter

Figure 1 — A 5-mm laparoscope is inserted through the subcutaneous tunnel.

was inserted over the stylet to ensure tip location in the midline at the Douglas pouch (Figures 2 and 3). After the stylet was retracted, the peritoneal cuff was placed into the incision (Figure 4).

With the help of a tunneling stylet, a subcutaneous tunnel was created in a latero-caudal direction from the infraumbilical wound to the left lower abdominal quadrant at the estimated catheter exit site. The end of the catheter was attached to the stylet and advanced along the tunnel, and the outer cuff was carefully fixed into the left side of the infraumbilical wound (Figure 5).

Figure 2 — Stylet is inserted angled toward the pelvis.

Figure 3 — The Tenckhoff catheter is placed in the pelvis, over the stylet.

Figure 4 — The deep and superficial cuffs are fixed.

The skin incision was then subcuticularly sutured with 5-0 polydioxanone. After the peritoneal cavity was flushed with 200 – 300 mL dialysate to test catheter function and assess for gross leakage or bleeding, the catheter was heparinized and capped for 2 weeks before use.

RESULTS

The 44 individuals who underwent 1-port laparoscopic insertion of a straight Tenckhoff catheter included 17 male patients (38.6%) and 27 female patients (61.4%). Average age was 56.3 years (range: 5 – 82 years), and average body mass index was 22.81. The mean operative time was 51 minutes, which included induction of anesthesia. Among the 44 patients, only 1 required adhesiolysis because of a midline bowel adhesion from a previous abdominal surgery. The mean follow-up period was 11.5 months (range: 2 – 21 months).

All catheters were working properly. No postoperative abdominal wall hemorrhages, early leaks, hernias, or catheter migrations occurred. Early and late procedure complications were defined as within and after 1 month respectively. Early complications are usually related to surgical technique, and late complications can be a result of multiple factors. No exit-site or tunnel infections were observed. One patient developed peritonitis 3 months after catheter placement, and that patient's catheter was removed.

Figure 5 — Completion of the Tenckhoff catheter placement.

DISCUSSION

Peritoneal dialysis has become a common treatment modality for patients with ESRD. Continuous ambulatory PD offers patients an alternative that is simple, easy to use, and inexpensive. Successful CAPD treatment depends on proper insertion and functional longevity of the dialysis catheter (17). In 1968, Tenckhoff invented the catheter cuff to induce fibrosis and thus create a seal against leakage and help to prevent infection (18). Since then, various techniques have been invented for CAPD catheter placement.

The optimal method for CAPD catheter insertion is a matter of controversy. Various techniques have been invented to improve the safety and longevity of the catheter (19–21). Traditionally, CAPD catheters have been inserted through a small laparotomy and blindly placed into the pelvis. Overall complication rates—including catheter obstruction, infection, and dialysate leakage—were reported to be up to 56% (22,23). Nowadays, more surgeons choose to perform laparoscopic surgery for CAPD catheter placement. In many studies, lower short-term complication rates and higher long-term catheter survival have been reported for laparoscopic surgery compared with traditional laparotomy (24–32).

In our practice, we prefer laparoscopic insertion of the CAPD catheter. Laparoscopic surgery has the benefit of enabling a thorough examination of the peritoneal cavity and the performance of concomitant surgical procedures such as adhesiolysis and omentum resection (33,34).

Although most surgeons using the laparoscopic technique choose to place the CAPD catheter through a rectus sheath tunnel with or without omentum resection or omentopexy, we create a subcutaneous tunnel instead, providing good extraperitoneal fixation without additional suturing. Our 1-port technique is relatively simple, quick, and easy to perform. The 7-cm oblique subcutaneous tunnel is long enough to generate a valve-like mechanism once intra-abdominal pressure increases, which further prevents leakage. Compared with other laparoscopic techniques, our method has so far showed no increased complication rates.

We started this 1-port technique using a 10-mm laparoscope, and we found that the rate of herniation at the port site was still high because of excess space around the catheter entry. We then switched to the 5-mm laparoscope at the entry site for the CAPD catheter, and in this way, the skin is left snug around the catheter, lessening the chance of herniation. With the aid of the guiding stylet passed through the 5-mm port to the pelvis, we make sure that the catheter tip is placed in the lower peritoneal cavity, thus lessening the possibility of migration and dislocation. We place the deep cuff of the catheter in the subcutaneous tissue because that placement is less traumatic. Our 1-port method also provides good cosmesis compared with traditional techniques.

The International Society for Peritoneal Dialysis guideline to place the catheter at least 2 weeks before PD start was followed strictly in this study. That timing reduced the potential for complications associated with early use of the catheter and contributed to our low overall complication rate. During the follow-up period, we observed no major complications. Only 1 patient developed peritonitis 3 months after catheter insertion, and that patient's catheter was removed. Early results were promising. The incidence of peritonitis has not been higher than that seen with other insertion methods. Long-term complications such as pseudohernia, pericatheter hernia, and late leakage still have to be monitored. Further studies and a greater number of patients are required to confirm our preliminary results.

CONCLUSIONS

Our 1-port technique for CAPD catheter is simple, fast, and safe. Low complication rates and the advantages of laparoscopic surgery justify consideration of our method for standard Tenckhoff catheter placement.

DISCLOSURES

Funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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