A surgical technique for providing peritoneal dialysis access at the University Medical Center Ljubljana

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Key words

end-stage renal disease, peritoneal dialysis, peritoneal dialysis catheter insertion, laparoscopy

Original article

SURGERY SURG ENDOS 2019;1: 27-30

Abstract

Background. Dialysis is becoming more common as the number of patients with end-stage renal disease increases. Two main modalities of dialysis are hemodialysis and peritoneal dialysis. Continuous ambulatory peritoneal dialysis has been used as a major renal replacement therapy since the early 1980s.

Methods. This article presents a brief review of current peritoneal dialysis catheter placement techniques, such as the open surgical technique, peritoneoscopic technique, blind percutaneous technique, and laparoscopic technique. Peritoneal dialysis has several advantages over hemodialysis, such as increased patient mobility, fewer dietary restrictions, improved preservation of residual kidney function, and no required systemic anticoagulation. An important aspect for successful peritoneal dialysis is to provide quality peritoneal dialysis access.

Conclusion. At our institution, laparoscopic insertion of a peritoneal dialysis catheter has become a standard method for providing peritoneal dialysis access in adults.

Introduction

Continuous ambulatory peritoneal dialysis (CAPD) is a validated and generally accepted alternative method to hemodialysis (HD) for treating patients with end-stage renal disease (ESRD). A very important aspect for successful peritoneal dialysis (PD) is the presence of a functioning PD catheter that allows adequate inflow and outflow of the dialysate solution [1]. In 1959, Richard Ruben was the first to use PD successfully in a patient with ESRD for 6 months. In 1968, Henry Tenckhoff developed the PD catheter, which was inserted with an open surgical technique. PD was later popularized by Popovich and Moncrief, who developed the concept of CAPD. Several advantages of PD over HD have been described, including better quality of life due to patient mobility and independence, its simplicity of use, maintenance of resid-

ual renal function, and lower mortality in the first years after the beginning of PD [2].

Types of peritoneal dialysis catheters

Most PD catheters are made of silicone, but some of them are made of polyurethane (e.g., the Cruz catheter). The advantage of silicone is reduced irritation to the peritoneum; however, polyurethane catheters are stronger and can thus be thin-walled with larger lumens [3]. At our institution we use straight Tenckhoff PD catheters with a coiled tip and two Dacron cuffs (Figure 1). The PD catheter can be divided into three segments. The intraperitoneal segment is the part of the PD catheter lying within the peritoneal cavity. The intramural segment is the segment between both cuffs and is located within the abdominal wall. The external segment is located outside the abdominal wall (Figure 2). The cuffs induce a local inflammatory response and tissue fibrosis that serve to anchor the catheter, prevent leaks around the catheter, and prevent bacterial migration from the exit site or from the peritoneum into the subcutaneous tunnel. Double-cuffed catheters are favored over single-cuffed catheters in adults because they anchor better in the abdominal wall, and they minimize exit site infections, tunnel infections, and peritonitis [3, 4].

Peritoneal dialysis catheter insertion technique

At our institution, for the past few years, the standard technique for providing PD access in adult patients is laparoscopically assisted insertion of the PD catheter. The procedure is performed under general anesthesia, and the patient must be fit for it. If there is any contraindication for general anesthesia, then the laparoscopic insertion is contraindicated [6].

The patient is placed in a supine position and general endotracheal anesthesia is induced. Perioperative antibiotic prophylaxis with cefazolin is administered 30 to 60 minutes prior to skin incision. The patient's abdomen is prepared and draped in the standard sterile fashion. The upper border of the curved catheter tip is aligned with the upper border of the pubic symphysis and the positions of the deep cuff, subcutaneous cuff, and skin exit site are marked with a sterile pencil (Figure 3). The first incision is 5 mm in length just above the umbilicus. A Veress needle is inserted and pneumoperitoneum with carbon dioxide (CO_2) is created. The intra-abdominal CO_2 pressure is maintained around 12 mmHg. A 5 mm trocar and a 5 mm 30-degree laparoscope are inserted. Laparoscppy is performed, and the pelvic region in particular is inspected for possible adhesions or any other pathology. Then the second 5 mm trocar is inserted in the right or left mesogastrium, depending on the side of skin exit site, and the laparoscope in moved to the second port (Figure 4). Another skin incision is made at the point of external cuff location, and rectus sheath tunneling is performed with a special trocar (Figure 5). Under laparoscopic guidance, the abdominal cavity is entered with a special trocar and a PD catheter is inserted through the trocar (Figures 6 and 7). Prior to the insertion, the PD catheter is soaked in saline. The curved tip of the catheter is placed into the Douglas pouch, the internal cuff should be in a preperitoneal space, and the external cuff should be placed subcutaneously. The pneumoperitoneum is released so that the subcutaneous tract can be created with the abdomen in a normal contour without the distortion that occurs with insufflation. After placing the catheter in the

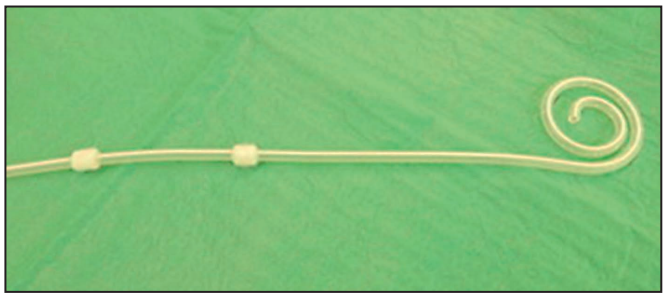

Figure 1. Straight Tenckhoff catheter with coiled tip and two Dacron cuffs.

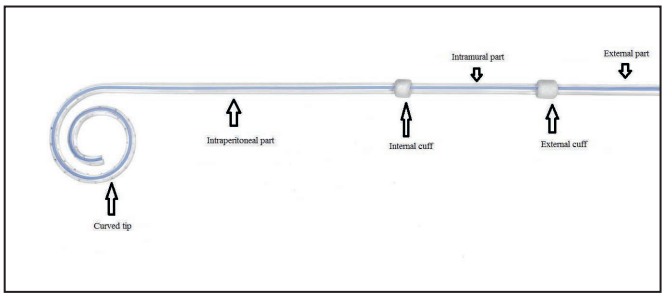

Figure 2. Segments of the PD catheter.

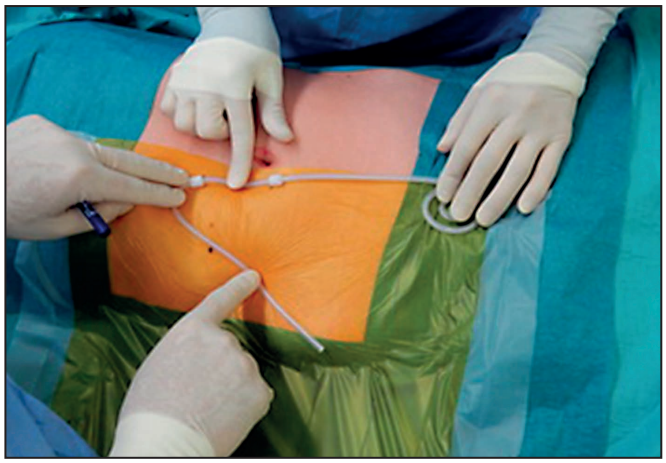

Figure 3. The upper border of the curved catheter tip is aligned with the upper border of the pubic symphysis and the positions of the deep cuff, subcutaneous cuff, and skin exit site are marked with a sterile pencil.

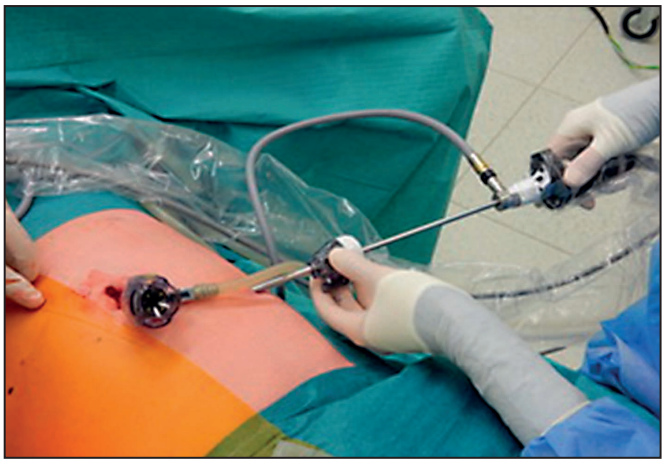

Figure 4. Laparoscopy with two 5 mm ports and a 5 mm scope.

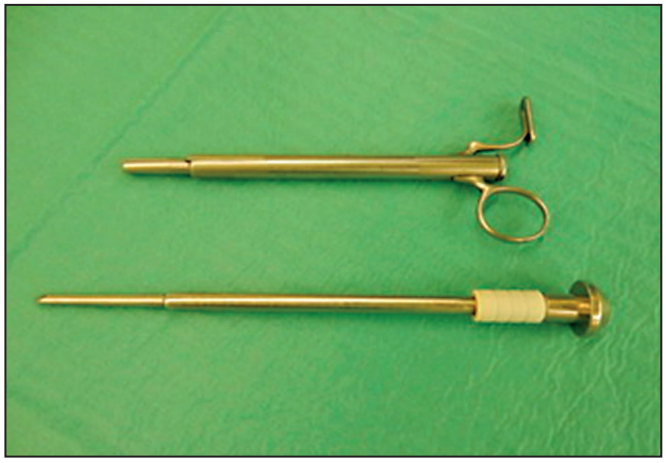

Figure 5. The special trocar that we use for rectus sheath tunneling.

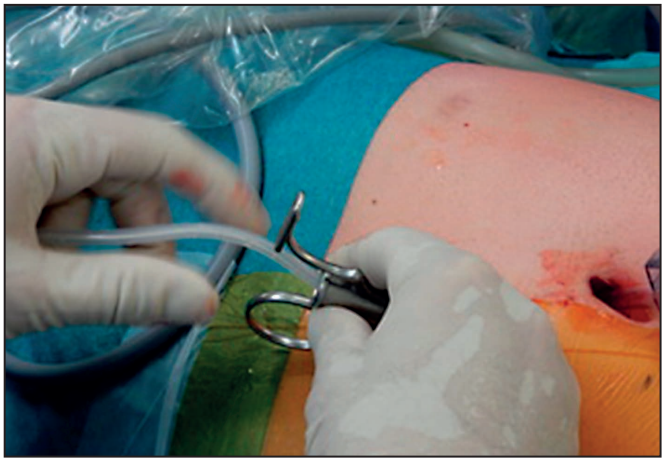

Figure 6. Rectus sheath tunneling and inserting the PD catheter.

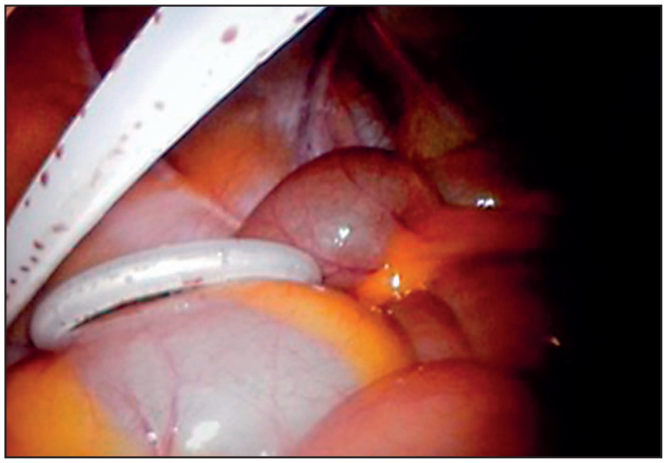

Figure 7. Endoscopic view of PD catheter insertion.

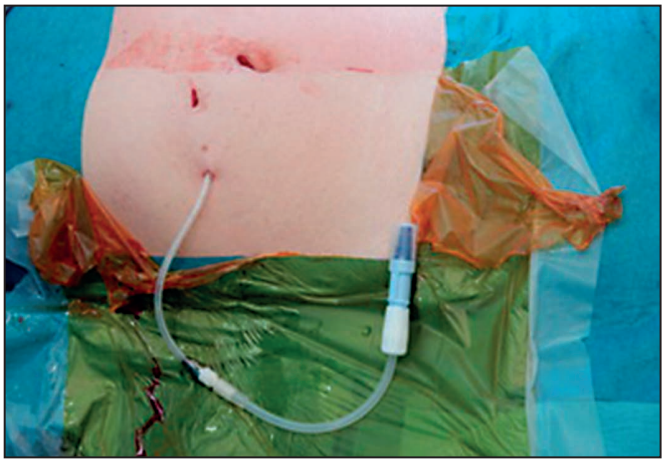

Figure 8. Inserted PD catheter directed downward with skin exit site placed laterally.

abdominal wall and the coiled tip sits in the retrovesical space, the remaining catheter is tunneled subcutaneously using a stylet to the planned exit site. The skin exit site is placed laterally, and the catheter should be oriented downward (Figure 8).

The PD catheter is flushed with saline and the patency of the catheter is evaluated immediately after the implantation procedure. Peritoneal lavage with a small volume of dialysate fluid is performed; the inflow and outflow of the dialysate fluid are evaluated. If the inflow or outflow is insufficient, the PD catheter can still be corrected.

Discussion

In recent years, there has been considerable interest in the use of laparoscopy for creating peritoneal access. As with any new application modality, laparoscopy for peritoneal access is still undergoing procedure-specific adaptations. It has become apparent that simply using laparoscopy to verify catheter location is not enough. The advantage of laparoscopy is that it allows an opportunity to actively address problems that adversely affect catheter outcome, such as catheter tip migration, omental entrapment, and peritoneal adhesions. The advantages of laparoscopy over other catheter insertion techniques are the identification and attendance to these problems at the time of the catheter insertion procedure [6]. Laparoscopic insertion is a minimally invasive procedure. It is suitable in obese patients, and complications can be managed laparoscopically [7]. Prior reports described several insertion techniques and port placements. Some authors reported a combination of 5 mm and 10 mm ports, and others described a minilaparoscopic technique, using 2 mm and 3 mm ports, to avoid herniation and fluid leak [8]. If additional procedures are performed, such as omentectomy or omentopexy, then a third port is needed [9].

We use two 5 mm ports and a 5 mm 30-degree laparoscope, unless there is simultaneous cholecystectomy because of gallstones. In that case, we use standard ports for laparoscopic cholecystectomy (10 mm umbilical port, 11 mm epigastric port, and two 5 mm right subcostal ports) and a 10 mm 30-degree laparoscope. We do not perform routine omentectomy or omentopexy. Some authors recommend fixation of the catheter tip to the pelvic structures to prevent catheter tip migration [10]. We do not perform routine catheter tip fixation because based on our experience the proper rectus sheath tunneling and positioning of the catheter tip in the Douglas pouch is sufficient to prevent catheter tip migration.

Conclusion

Laparoscopic insertion of a PD catheter has become the standard method for providing PD access at our institution in adult patients that need chronic PD because of ESRD. Based on our experience, the method is safe, is reliable, and has minimal complications.

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