How I do it

A new simplified one port laparoscopic technique of peritoneal dialysis catheter placement with intra-abdominal fixation

Haralampos V. Harissis, M.D. a,*, Christos S. Katsios, M.D. a, Elli L. Kolioussi, M.D. b, Margarita G. Ikonomou b, Konstantinos C. Siamopoulos, M.D. b, Michalis Fatouros, M.D. a, Angelos M. Kappas, M.D. a

a Department of Surgery, University Hospital of Ioannina, Panepistimiou Av., Ioannina 45500, Greece
b Department of Nephrology, Medical School, University of Ioannina, Ioannina, Greece

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Abstract

Background: Various laparoscopic techniques have been described for the insertion of peritoneal dialysis catheters. However, most use 3 to 4 ports, thus multiplying the potential risk for abdominal wall complications (hemorrhage, hernia, leaking).

Methods: A Tenckhoff catheter was placed laparoscopically, using just 1 port, in 13 consecutive patients with end-stage renal failure. All catheters were fixed in the abdominal cavity with no additional ports for this purpose.

Results: After a follow-up of 76 patient-months, all catheters are working properly. There were no postoperative wall hemorrhages, early leaking, or hernias. There was 1 case of catheter migration and 2 cases of late leaking in 2 patients in total, due to severe constipation. There were no exit site or tunnel infections. One episode of peritonitis was successfully treated with antibiotics.

Conclusion: The simplicity and the rapidity of the method justifies serious consideration for its use as the standard Tenckhoff catheter placement. © 2006 Excerpta Medica Inc. All rights reserved.

Keywords: Laparoscopy; Tenckhoff catheter insertion techniques

An estimated 120,000 patients worldwide are using peritoneal dialysis for renal replacement therapy [1]. Since the original description of the method in 1968 by Tenckhoff [2], different peritoneal catheter placement modalities have been proposed. The standard method has been either surgical minilaparotomy or blind bedside insertion according to the Seldinger technique [3,4]. Peritoneoscopy has gained acceptance since its introduction by Ash [5,6]. In 1998, the above 3 methods were described by the “Official Report of the International Society for Peritoneal Dialysis” as accepted techniques with no indication that 1 technique is superior to the other [7].

The laparoscopic method was introduced in the early 1990s by Adamson et al [8] and Amerling et al [9]. The advantages of complete visualization of the implantation, secure fixation of the catheter in the peritoneal cavity, and the possibility to deal with adhesions at the same time, have been the main arguments in favor of a laparoscopic choice versus all other techniques, a fact that explains the continuously increasing number of series reports [10]. According to the “European Guidelines on Best Practice for the Management of Peritoneal Dialysis” of 2002, no implantation technique has been shown to be definitely superior to others, but catheters should preferably be implanted operatively or by laparoscopy [11]. One randomized control study confirmed important advantages with laparoscopic implantation versus minilaparotomy [12], but another showed that laparoscopy was more time-consuming without better catheter outcomes [13]. An explanation for such controversial results may be the different laparoscopic techniques that have been used in the studies. Several laparoscopic techniques have been described, most of them using 3 to 4 ports [8–10,14–19]. However, it is well known that each port entry creates a weak abdominal site where a hernia or leaking could develop. We describe here a new laparoscopic technique that combines all the advantages of laparoscopy and those of the other methods while using just 1 port.
Methods

Through a supra-umbilical 1-cm incision, a 10-mm port is placed using the open laparoscopic technique [20]. This port serves for the pneumoperitoneum installation and the introduction of the optics. The Peritoneal Catheter kit (Quinton Instrument Company, Seattle, WA) for modified Seldinger (Littleford-Spector) technique and a 16 French Pull-Apart Sheath Introducer (Sherwood Medical Company, St. Louis, MO) are used for the catheter placement. The length of the catheter to be inserted has been calculated preoperatively at the patient’s bedside. A point midway of the umbilico-crestal line is selected as insertion site of the catheter and a 0.5-cm incision is made at the selected abdominal entry site. With blunt dissection, a subcutaneous pocket for the deep cuff of the catheter is prepared. Under direct visualization through the camera, the abdominal wall and the peritoneum are punctured using a 16-gauge needle from the catheter placement kit, directing it caudal and posterior, attention being paid not to traumatize the inferior epigastric vessels. Direct visualization of these vessels from the interior of the abdominal cavity helps to avoid this danger. A guidewire is introduced through the needle and the needle is removed. A Pull-Apart sheath with a dilator is then passed over the guidewire into the peritoneal cavity and the guidewire is then removed (Fig. 1).

The dilator is removed and the Tenckhoff catheter is advanced through the Pull-Apart sheath. A point just lateral to the lower part of the left lateral umbilical ligament is selected for the placement of a loop of a nonabsorbable suture (nylon 2-0), which will serve for the catheter fixation at the anterior abdominal wall (Fig. 1). This is accomplished with the help of an intravenous catheter needle of a large caliber (16 G) through which the nylon is passed through (Fig. 2).

The tip of the loop is interiorized in the catheter needle, which then is inserted into the abdominal cavity under direct visualization at the previously selected site (Fig. 3).

The loop is then exteriorized from the tip of the catheter needle into the abdominal cavity and the Pull-Apart sheath carrying the Tenckhoff catheter is passed through the loop (Fig. 4).

The Pull-Apart sheath is removed leaving the Tenckhoff catheter passing through the nylon loop. The loop-introducing needle is removed and the nylon is sutured (with the help of a free needle on a needle holder) on the subcutaneous fascia of Scarpa or on the anterior rectus sheath and tied. The Tenckhoff catheter is in this way fixed at the lower anterior abdominal wall.

What follows is the standard technique for the creation of a subcutaneous tunnel for the catheter. With the aid of the tunneling stylet of the catheter kit, a subcutaneous tunnel is fashioned in a latero-caudal direction. The end of the catheter attached to the stylet is advanced into the tunnel, taking care to leave the outer cuff at a distance of 2 to 3 cm from the exit site. After removal of the pneumoperitoneum and the closure of the midline incision with a purstring poly-
Dioxanone suture (PDS II; Ethicon, Inc, Somerville, NJ), an in-out test is performed to detect any leaks from the abdominal incisions or flow obstacles. All skin incisions are then sutured. The catheter is heparinized and kept capped for 2 weeks.

Results

From March 2004 to February 2005 we used this technique on 13 consecutive patients with end-stage renal failure. The contraindications for the technique were those regarding general anesthesia and pneumoperitoneum. Three patients had previous operations of the lower abdomen. One of these patients necessitated the use of an additional port for adhesiolysis. No case was converted to open surgery. The patients were evaluated monthly for a mean follow-up period of 5 months.

One surgeon (H.H) with an interest in access surgery performed all operations.

Mean operative time was 20 minutes (range 15 to 35 minutes). No operative or immediate postoperative complications have been observed. Patients were dismissed on the second postoperative day. There were no hemorrhages, early leaking, or postoperative hernias on either port or catheter entry site. There was 1 (7.6%) incidence of catheter migration and 2 incidences (15%) of late leaking, defined as leaking from the exit site of the catheter after the first month postoperatively. These 3 incidences occurred in 2 patients in total. The first patient presented with catheter migration and late leaking and the other patient with late leaking only. Both patients had serious constipation with small bowel distention that filled the pelvis, leading to the displacement of the catheter in the first patient and to a significant increase of intra-abdominal pressure in both patients (>18 cm H$_2$O/1 liter 3.86% dextrose water), a fact that explains well the late leaking episodes. Both patients were treated successfully with temporary continuous ambulatory peritoneal dialysis discontinuation for 15 days while the catheter tip repositioning was achieved by means of radioscopic wire manipulation. The constipation, recognized as the principal cause of the complication, was carefully monitored with dietary measures and laxatives.

There were no exit site or tunnel infections. There was one episode of peritonitis, which was successfully treated with antibiotics. All 13 catheters are still functioning properly (the cumulative duration of follow-up is 76 patient-months).

Comments

Since the lack of controlled studies makes it impossible to answer in a definitive way which technique for peritoneal dialysis catheter placement is best, we prefer to approach the problem as a 2-fold question: what is the safest access in the peritoneal cavity for the catheter placement and which technical factors influence the longevity of a peritoneal catheter?

For the first problem, a wise solution would be a method whose access combines the pros of every method—local anesthesia (as with minilaparotomy, peritoneoscopy, blind insertion), minimal invasive technique (as with blind insertion), safe entry in the peritoneal cavity (as with minilaparotomy and open laparoscopy), complete visualization of the procedure (as with laparoscopy) that protects from the serious complication of viscera perforation, and possibility of adhesiolysis (as with laparoscopy)—while the same time avoids the cons—need for special instrumentation (as with peritoneoscopy), and large abdominal wall dissections or many port sites (as with minilaparotomy and the current laparoscopic methods). The laparoscopy technique that we describe here assures safe entry into the abdominal cavity, whole process visualization, and a possibility for adhesiolysis (in which case 1 to 2 additional ports are needed). Furthermore, we use the existing materials available at any institution that performs laparoscopic surgery, abundantly familiar to all the surgeons and thus avoiding the need for special instrumentation, as the Y-Tec peritoneoscope (Medigroup, Inc, IL). Finally, our 1-port technique assures a minimized abdominal wall trauma while keeping the cost of the operation at the lowest level. The only pro that is not included in our technique is local anesthesia. Although laparoscopic placement of dialysis catheters by laparoscopy under local anesthesia is possible [21], we feel that the comfort of the patient is secured better with general anesthesia providing that the risks of short-duration general anesthesia have been eliminated by a careful preoperative control.

The good function and the longevity of a catheter are dependent on several technical key factors, which must be respected whatever the method used. First, the intraperito-
neal portion of the catheter should be between the parietal and visceral peritoneum and directed toward the pelvis to the right or the left of the bladder. Thus, blind positioning of the tip of the catheter (as with blind insertion, minilaparotomy, and peritoneoscopy) is considered disadvantageous in the opinion of most investigators. With direct visualization through laparoscopy, one can avoid bowel loops, adhesions, and omentum and determine the most suitable site for catheter placement. Second, it is well known that port sites are potential sources of postoperative leakage (4% to 12% of cases) [4,6], abdominal wall hematoma or hemorrhage (5%) [22], and hernia formation (7%) [22]. These complications are responsible for one fifth of the total mechanical complications occurring with peritoneal dialysis, and they pose serious problems to patients and could even lead to catheter loss. The most cited laparoscopic techniques use 3 or 4 ports [10,19] thus multiplying the potential risk from each port site. A single 1-port technique has been previously described, but this method necessitates a laparoscope with a special working channel and it does not include fixing of the catheter in the abdominal cavity [23]. Fixing the catheter in the abdominal cavity is recognized as an absolute necessity by most laparoscopic surgeons in order to avoid catheter migration resulting in poor return of dialysate [10,12,24]. Indeed, after open surgical techniques the incidence of catheter migration has been reported to be between 16% and 54%, while in laparoscopic methods with catheter fixation it is only 9% [25,26]. However, this supplementary laparoscopic gesture necessitates 2 additional ports, explaining the 3 to 4 ports used by most surgeons. With our technique, no additional ports are needed for this purpose. We use only 1 port, which we close safely under direct vision with a pursestring suture. The entry site of the catheter is of the same caliber as the catheter, thus leaving no place for hernia formation. It should be noted, as well, that we disagree with the principle of fixation of the catheter on the uterus or the bladder as advised in all laparoscopic series because this involves the danger of internal small bowel herniation between the abdominal wall and the catheter. The fixation at the abdominal wall, as described here, leaves no space for such an event. Last, we prefer to put the deep cuff of the catheter in the subcutaneous tissue because we find this to be less traumatic. Although, traditionally, it is preferably placed within the rectus muscle [20], in series with a large number of patients where the deep cuff was placed subcutaneously there were no adverse effects directly connected to its positioning [22].

In our series we had so far no hernia or abdominal wall hemorrhage. The 2 cases of late leaking and the 1 case of catheter migration were all due to severe increase of intra-abdominal pressure. The percentage of late leaking in our series compares favorably with that of other series, which varies between 5% and 30% [27]. Although complications like these inevitably must be expected no matter what method is used, one can logically conclude that by minimizing the traumatic surface of the abdominal wall by using just 1 port during catheter insertion, a reduction of the potential risk for such late complications can be obtained. Our results compare favorably with those of similar (in terms of follow-up), previously reported laparoscopic techniques [10,16,18]. Given our favorable short-term results, we question the need for a double-blind randomized study.

We conclude that the simplicity and the rapidity of the method, which at the same time respects the technical rules for safe peritoneal access and catheter longevity, justifies serious consideration of this technique for standard Tenckhoff catheter placement.

References


