Single-port laparoscopic placement of peritoneal dialysis catheter: A safe and effective technique

Ahmed Kamal Gabr[a], MD; Mohamed M. Tawfik[a], MD; HosamSaleh[a], MD; AmgadAwad[b], MD

a) Department of Vascular Surgery, Ain Shams University, Cairo, Egypt.
b) Department of Internal Medicine, Al-Azhar University, Cairo, Egypt.

Background/Aim: *Laparoscopic techniques for placement of peritoneal dialysis catheters are becoming increasingly popular. Currently, there are several techniques for such laparoscopic approach. The aim of this study is to describe our technique and outcomes of using single port laparoscopic placement of peritoneal dialysis catheters.*

Patients and methods: *Laparoscopic implantation of peritoneal dialysis catheters was performed in 64 consecutive patients.The technique was performed via a single port inserted in the supra-umbilical region. The tip of the catheter was placed in the true pelvis while its deep cuff was placed into the rectus sheath. A subcutaneous tunnel was created to the selected exit site of the catheter. Mean duration of surgery, hospital stay, morbidity, mortality, and catheter survival were assessed.*

Results: *The mean operating time was 22 ± 7 minutes. The mean post-operative hospital stay was 2 ± 1 days.There were no conversions from laparoscopy to conventional catheter insertion methods. No exit-site or tunnel infections, hemorrhagic complications, abdominal wall hernias, or catheter cuff extrusions were detected. No mortality occurred in this series of patients. Catheter survival was 100% and 96.8% at 6 months and one year respectively.*

Conclusion: *The laparoscopic method described in this study is compliant with consensus guidelines for the best-demonstrated practices in peritoneal dialysis access placement. The results reported in this paper support the opinion that laparoscopic placement of peritoneal dialysis catheter should become the standard care for clinical practice. The use of single-port technique is safe, effective and reproducible method.*

Key words: *Laparoscopy; peritoneal dialysis catheters.*

Introduction:

Continuous ambulatory peritoneal dialysis (CAPD) has become a widespread mode of dialysis for patients with chronic renal failure. The surgeon's role in caring for these patients is to provide access to the peritoneal cavity via a peritoneal dialysis (PD) catheter and to diagnose and treat catheter complications.

In 1968, Tenckhoff and Schechter[1] described a percutaneous nonvisualized method of catheter placement. However, this was associated with a risk of bowel or vessel injury, as well as a high incidence of malpositioned catheters resulting in failure rates of up to 65% at 2 years. Subsequently, the gold standard became open placement under direct surgical vision via mini laparotomy.[2] However, placement of the catheter tip into the pelvis is essentially a blind technique. This technique has resulted in up to a 22% incidence of drainage dysfunction.[3] Two major factors that may be involved in catheter dysfunction are inadequate placement of the catheter tip into the pelvis, which allows the catheter to migrate and become entrapped within the omentum, and the presence of intraabdominal adhesions, which interfere with correct catheter placement.[4]

In an attempt to improve catheter function and decrease complications, in 1981 Ash et

al[5] reported on a peritoneoscopic technique. He used a special needlescope (YTEC, Medigroup, Inc., North Aurora, IL) with surrounding cannula and catheter guide. This method reduced the early failure rate to 3% in his hands. However, it does not allow for adhesiolysis, and furthermore, it requires specialized equipment.

Over the last decade, several reports have described laparoscopic[6-16] or minilaparoscopic[17-19] placement of PD catheters. This approach addresses many concerns by allowing direct visualization of the peritoneal cavity and exact placement of the catheter tip deep into the pouch of Douglas. It also allows laparoscopic adhesiolysis and omentopexy or omentectomy. One of the described laparoscopic techniques of placement of peritoneal dialysis catheter is the single- port technique.[20-21] The aim of this study is to describe our technique and outcomes of using a single-port laparoscopic placement of peritoneal dialysis catheters.

Patients and methods:

Patients: Between January 2010 and December 2012, 64 patients with end-stage renal disease underwent laparoscopic placement of Tenckhoff peritoneal catheters were included in the present study, 40 males and 24 females with mean age 36 ±8.1, at three tertiary referral hospitals in the eastern province of Saudi Arabia, each of them is 250 beds size, approximately 24 patients per year have been enrolled. All these patients either exhausted all hemodialysis vascular access or some of them asked for ambulatory peritoneal dialysis. Pre-operative investigations were done (blood tests) and all patients had been assessed by anesthesiologist. All patients were eligible to receive general anesthesia and pneumoperitoneum. Prophylactic antibiotic, cefazoline - or vancomycin in case of cephalosporin allergy - was administered at the time of induction of anesthesia. All patients signed terms of informed consent.

Method: The exit site in the right or left lower abdomen according to patient preference was marked. The patient was subsequently placed on the operating room table in a supine position with both arms tucked, and general anesthesia is administered. Perioperative prophylactic intravenous antibiotics were administered, the abdomen was prepped in a sterile fashion. A supraumblical 1.5 cm was done and an open insertion technique was utilized **Figure (1)**. Pneumoperitoneum was created with pressure limits for abdominal gas insufflation set between 10 and 12 mmHg.

We used a 10-mm trocar and zero-degree laparoscope and preliminary laparoscopy was performed to look for adhesions or other anatomical abnormalities that could hinder the performance of the peritoneal dialysis catheter **Figure (2)**.

Once the pelvis was inspected, attention was turned to the anterior abdominal wall. The entrance and exit sites are marked. It was helpful to lay the catheter on the abdomen to estimate the entrance site based on the length of the patient's torso. The tip should easily reach the cull-desac, thus the top of the curl should be at the pubic symphysis. We used a point midway between anterior suprior iliac spine and umblicus on the lateral border or rectus muscle as entrance site. We use a percutaneous insertion kit. A 1-cm incision was made at the insertion site, and the needle was inserted through the abdominal wall under direct laparoscopic vision. The needle was oriented obliquely to position the catheter in a caudad direction. The wire was advanced through the needle into the pelvis. The needle was removed, and the sheath and dilator were inserted over the wire by using the Seldinger technique. A 0.5 cm incision in the midline just above the symphysis pubis was done and a loop of proline 3.0 was inserted through a wide bore needle under vision and the sheath and dilator were manipulated till it passed through the loop **Figure (3)**.

The dilator was removed and the peritoneal dialysis catheter was fed through the sheath toward the pelvis. Once the catheter was inside the abdomen, the sheath was teared apart leaving the catheter in place. The loop was advanced till it gently fixed the catheter to the anterior abdominal wall **Figure (4)**. The external end was tunneled and pulled through an exit site lateral to the insertion site. It was

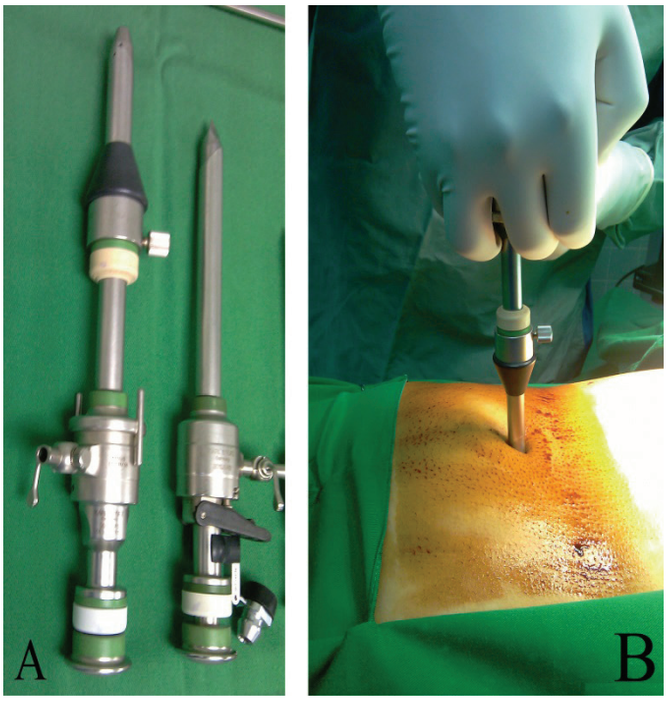

Figure (1): Hasson port (A) ana open tecnnique for pneumoperitoneum (B)

Figure (2): Operative photograph shows 10-mm Single-port in place.

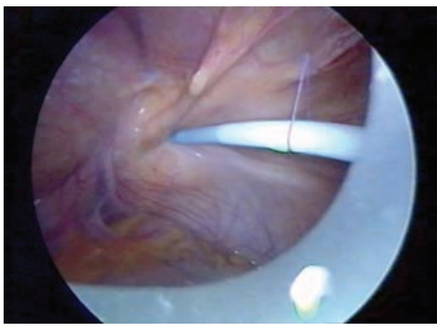

Figure (3): Operative photograph shows passage of the dilator through the percutaneously inserted proline loop.

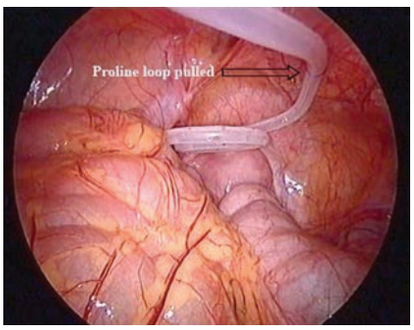

Figure (4): Operative photograph shows the peritoneal dialysis catheter in the true pelvis and find by gently-pulled percutaneous proline loop (arrowed).

Figure (5): Operative photograph shows using a hemostat to bury the internal cuff under the anterior rectus sheath.

important that the distal cuff was greater than 2 cm from the skin incision. The proximal or internal cuff was then buried under the anterior rectus sheath by using a hemostat **Figure (5)**. The entrance site was inspected internally using the laparoscope to verify that the cuff

was not advanced through the posterior sheath into the abdomen. Once the procedure was completed, the pneumoperitoneum was evacuated and the trocar was removed and the fascia was closed with a 2.0 Vicryl suture. The PD catheter was then tested by infusing 250cc of normal saline into the abdomen and then draining making sure that the catheter was functioning properly, it was locked with heparin 100 units/cc. The catheter was used no sooner than 2 weeks later.

Results:

The study group of patients comprising 64 consecutive laparoscopically implanted Tenckhoff catheters included 24 women and 40 men, with a mean age of 36 (range 19 –55) years. 2 patients had undergone previous minor intraperitoneal surgery (appendicectomy). The average operative time was 22 ±7 minutes and mean duration of hospital stay was 2 ±1 day. All patients started oral intake 2 hours post operatively. No post-operative antibiotic prophylaxis given. Postoperative pain was controlled with paracetamol tablets. There were no conversions from laparoscopy to any other conventional method of catheter placement. There were no hemorrhagic complications, no abdominal wall hernias, and no extrusion of the superficial catheter cuff were detected. Duration of postoperative follow-up was 1 year. No mortality occurred in this series of patients. Catheter survival was 64/64 (100%) at 6 months and 62/64 (96.8%) at one year. Early complications as leakage was 1/64 (1.6%), exit-site infection was 2/64 (3.1%), and catheter migration was 1/64 (1.6%). Late complications as bacterial peritonitis were 2/64 (3.1%), port-site hernia was 0/64 (0 %), and exit-site infection was 3/64 (4.7%). So, the total complications were 9/64 (14.1%).

Discussion:

The laparoscopic approach to placement of Tenckhoff PD catheters, introduced in the 1980s,[22] has advantages over open and percutaneous surgical techniques, such as a lower incidences of flow obstruction and visceral injury.[23] The method by which PD catheters are placed has a significant influence on catheter function, incidence of catheter-related complications, and technique survival. The single-port approach was developed later for management of obstructed catheters and placement of catheters into complicated abdomens. A competent and experienced operator must perform the catheter implantation procedure. Peritoneal catheter placement must be regarded as an important surgical intervention, demanding care and attention to detail equal to that of any other surgical procedure.[20-21]

Although the same single-port method has been used in previous studies, on both adults and children,[16,18,25] and one of the ports in some two-port studies has been actually been used in the same manner as the pull-apart introducer.[26,27] The distinctive characteristic of our technique is that we used of only one 10 mm port & the fixation of the catheter to the anterior abdominal wall. While obstruction of dialysate flow, port-site hernia, and leakage are three major causes of PD catheter failure,[13,27,28,29] these complications were rare in our study and intermediate-term catheter survival was 96.8%.

Due to its characteristics (simple, quick, efficient, andminimally invasive to the patient), together with our results support the opinion that laparoscopicperitoneal catheter placement should become thepreferred approach. In addition, the laparoscopic method offers an excellent view of the abdomen and optimal placement of the catheter within the cavity.

We did not experience intraoperative complications such as intra-abdominal organ injury, as has been reported for conventional techniques.[25-26] In fact, in our series we had no intra-abdominal catastrophes and the incidence of catheter displacement was 0% lower than thatreported using open surgery technique[24] or any laparoscopic technique. Furthermore, we did not encounter problems commonly reported for open catheter placement, such as hematoma, seroma, or infections. No perioperative mortality occurred in this case series.

Conclusion:

The laparoscopic method described in this study is compliant with consensus guidelines for the best-demonstrated practices in peritoneal dialysis access placement. The results reported in this paper support the opinion that laparoscopic placement of peritoneal dialysis catheter should become the standard care for clinical practice. The use of single-port technique is safe, effective and reproducible method.

Reference

1- Tenckhoff H, Schechter H: A bacteriologically safe perito-neal access device. *Trans Am Soc Artif Intern Organs*. 1968; 14: 181–187. [PubMed]

2- Nghiem DD: A technique of catheter insertion for uncomplicated peritoneal dialysis. *Surg Gynecol Obstet* 1983;157: 573–576.

3- Cronen PW, Moss JP, Simpson T, Rao M, Cowles L: Tenck-hoff catheter placement: Surgical aspects. *Am Surg*. 1985; 51(11): 627–629. [PubMed]

4- Bullmaster JR, Miller SF, Finley RK, Jones LM: Surgical aspects of the Tenckhoff peritoneal dialysis catheter. A 7 year experience. *Am J Surg* 1985; 149: 339–342. [PubMed]

5- Ash SR, Wolf GC, Bloch R: Placement of the Tenckhoff peritoneal dialysis catheter under peritoneoscopic visualization. *Dialysis & Transplant* 1981; 10: 82–86.

6- Brandt CP, Franceschi D: Laparoscopic placement of peritoneal dialysis catheters in patients who have undergone prior abdominal operations. *J Am Coll Surg* 1994; 178(5): 515–516. [PubMed]

7- Nijhuis PH, Smulders JF, Jakimowicz JJ: Laparoscopic introduction of a continuous ambulatory peritoneal dialysis (capd) catheter by a two-puncture technique. *Surg Endosc*. 1996; 10: 676–679. [PubMed]

8- Watson DI, Paterson D, Bannister K: Secure placement of peritoneal dialysis catheters using a laparoscopic technique. *Surg Laposc Endosc* 1996; 6: 35–37.

9- Crabtree JH, Fishman A: Videolaparoscopic implantation of long-term peritoneal dialysis catheters. *Surg Endosc*. 1999; 13: 186–190. [PubMed]

10- Cala Z, Mimica Z, Ljutic D, Jankovic N, Varlaj-Knobloch V, Cala S: Laparoscopic placement of the peritoneal dialysis catheter using a specially designed trocar: A review of 84 patients. *Dialysis & Transplantation* 2000; 29: 722–727.

11- Barone G, Lightfoot M, Ketel B: Technique for laparoscopy-assisted complicated peritoneal dialysis catheter placement. *J Laparoendosc Adv Surg Techn A* 2002; 12: 53–55.

12- Lu CT, Watson DI, Elias TJ, Faull RJ, Clarkson AR, Bannister KM: Laparoscopic placement of peritoneal dialysis catheters: 7 years experience. *Aust N Z J Surg* 2003; 73: 109–111.

13- Manouras AJ, Kekis PB, Stamou KM, Konstadoulakis MM, Apostolidis NS: Laparoscopic placement of Oreopoulos-Zellerman catheters in CAPD patients. *Peritoneal Dialysis Int.* 2004; 24: 252–255.

14- Crabtree JH, Fishman A: A laparoscopic method for optimal peritoneal dialysis access. *Am Surg* 2005; 71: 135–143. [PubMed].

15- Hagen SM, Lafranca JA, Steyerberg EW et al: Laparoscopic versus open peritoneal dialysis catheter insertion: A meta-analysis. *PLoS One* 2013; 8: e56351.

16- Harissis H, Katsios C, Koliousi E, et al: A new simplified laparoscopic technique of peritoneal dialysis catheter placement. *Am J Surg* 2006; 192: 125–129. [PubMed].

17- Batey C, Crane J, Jenkins M, Johnston T, Munch L: Mini-laparoscopy-assisted placement of Tenckhoff catheters: An improved technique to facilitate peritoneal dialysis. *J Endourol* 2002; 16: 681–684. [PubMed].

18- Varela J, Elli E, Horgan S: Mini-laparoscopic placement of a peritoneal dialysis catheter. *SurgEndosc.* 2003; 17(12): 2025–2027. [PubMed].

19- Yun E, Meng M, Brennan T, McAninch J, Santucci R, Rogers S: Novel microlaparoscopic technique for peritoneal dialysis catheter placement. *Urology* 2003; 61: 1026–1028. [PubMed].

20- Leung LC, Yiu MK, Man CW, Chan WH, Lee KW, Lau KW: Laparoscopic management of Tenckhoff catheters in continuous ambulatory peritoneal dialysis. A one-port technique. *Surg Endosc* 1998; 12: 891–893.

21- Milliken I, Fitzpatrick M, Subramaniam R: Single-port laparoscopic insertion of peritoneal dialysis catheters in children. *Journal of Pediatric Urology* 2006; 2: 308–311.

22- Gokal R, Alexander S, Ash SR, Chen TW,

Danielson A,Holmes C, et al: Peritoneal catheters and exit-site practicestoward optimum peritoneal access: 1998 update. *Perit Dial Int* 1998; 18: 11–33.

23- Dombros N, Dratwa M, Feriani M, Gokal R, Heimburger O,Krediet R, et al: EBPG-Expert Group on Peritoneal Dialysis. European best practice guidelines for peritoneal dialysis and peritoneal access. *Nephrol Dial Transplant* 2005; 20: ix8–12.

24- Lund L: Peritoneal dialysis catheter placement: Islaparoscopy an option? *Int Urol Nephrol* 2007; 39: 625–628.

25- Asif A: Peritoneal dialysis catheter insertion. *Minerva Chir* 2005; 60: 417–428.

26- Adamson AS: Endoscopic placement of CAPD catheters:an overview of one hundred procedures. *Nephrol Dial Transplant* 1992; 7: 855–857.

27- Brandt CP: Laparoscopic placement of peritoneal dialysiscatheters in patients who have undergone prior abdominaloperations. *J Am Coll Surg* 1994; 178: 515–516.

28- Cala Z: Laparoscopic placement of the peritoneal dialysiscatheter using a specially designed trocar: A review of 84 patients. *Dial Transplant* 2000; 11: 722–727.

29- Ranganathan D, Baer R, Fassett RG et al: Randomised controlled trial to determine the appropriate time to initiate peritoneal dialysis after insertion of catheter to minimise complications (Timely PD study). *BMC Nephrol* 2010; 11: 11.