Laparoscopic Retrograde Peritoneal Dialysis Catheter Insertion: Technique and Outcomes

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Objective: *The study aimed to present technique and outcomes of laparoscopic retrograde peritoneal dialysis catheter insertion in chronic kidney disease (CKD) patients.*
Material and Method: *We retrospectively reviewed 11 complicated CKD patients, who underwent both laparoscopic and laparoscopic retrograde peritoneal dialysis catheter (lap PD, r-lap PD) insertion at HRH Princess Maha Chakri Sirindhorn Medical Center during April 2013 to March, 2016. Technique, outcomes and complications were presented.*
Results: *After a follow-up period of 14 months in patients who underwent lap PD insertion, there was no infection, bleeding complication, or hernia presented. Dialysate leakage after immediate dialysis was found in one r-lap PD insertion patient but healed spontaneously. No catheter removal or revision was observed.*
Conclusion: *The described r-lap PD catheter insertion technique was straightforward, effective and reproducible. Though the sample size was limited, the procedure can used as an alternate in complicated CKD patients.*

Keywords: *Peritoneal dialysis, Laparoscopic insertion, Renal replacement therapy, Peritoneal dialysis catheter*

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Chronic kidney disease (CKD) is one of the major health problems worldwide. In Thailand, Ingsathit A et al[1] reported an overall CKD prevalence was 17.5% which ranged from 3.3% in CKD stage I to 1.1% in CKD stage V. Kidney replacement therapy composes of hemodialysis and peritoneal dialysis. Peritoneal dialysis has benefit over hemodialysis in terms of renal function preservation and allows self-autonomy. Moreover, peritoneal dialysis was more cost-effective than hemodialysis in Thailand setting[2] leading to the launch of "PD first policy" by National Health Security Office (NHSO) in 2008. Subsequently, the number of patients required peritoneal dialysis has risen significantly over nation. Key success of peritoneal dialysis is the survival of PD catheter. After introduced by Tenckhoff in 1968[3], method of peritoneal dialysis catheter placements are extensively developed. There are many techniques for peritoneal dialysis (PD) catheter placement, such as Seldinger technique[4], peritoneoscopy[5,6], fluoroscopic guided[7,8], open and laparoscopic placement technique. In Thailand, open placement technique or minilaparotomy is extensively practiced nationwide. Most of PD placement techniques are blind technique resulted in malposition and dysfunctional catheters. Outflow obstruction which caused by omental wrapping and tip migration had been reported as high as 8-10% after PD catheter insertion[9,10]. Laparoscopic PD catheter placement was firstly developed in 1993 by Amerling R et al[11], aiming to improve PD catheter survival rate by using "direct vision technique". Though, recommendations of International Society for Peritoneal Dialysis (ISPD) in 2005[12] claimed the similar outcomes among many PD placement techniques in uncomplicated patient, laparoscopic peritoneal dialysis catheter (lap PD) insertion has gained acceptably in many centers. Lap PD insertions are advocated in previous abdominal operation patients due to significance of clearly visual abdominal exploration[13,14]. Moreover, lap PD insertions allow surgeons to fix PD catheter, lysis adhesion, do omentoplexy and simultaneous hernia repair[15,16].

Since laparoscopic surgery has a significant leap and was worldwide recognized over the past ten years, many lap PD insertion techniques has also been developed. No study about technique of laparoscopic retrograde PD catheter (r-lap PD) insertion has yet been

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reported in Thailand. The study aims to address this technique and evaluate the outcomes and difficulty of PD catheter insertion in our institute. The results will assist the physician to innovate and develop a new treatment for CKD patients.

Material and Method

A retrospective study intended to present the technique, early results and pitfall of r-lap PD placement in CKD patient. After obtaining ethical approval from the Institutional Review Board of the Faculty of Medicine of Srinakharinwirot University, we retrospectively reviewed CKD patients who underwent lap PD catheter insertion at HRH Princess Maha Chakri Sirindhorn Medical Center. Between April 2013 to March 2016, 11 CKD patients who were eligible for lap PD insertion which aged more than 18 years were included. We excluded patients who had no follow-up data. Four patients had lap PD insertion in an old fashion and 7 patients had r-lap PD insertion. Demographic data, outcomes, and associated complications were collected from medical record. Data were analyzed by SPSS version 17 statistical package and reported in mean and percent.

Techniques

All patients were operated under general anesthesia and prophylactic antibiotics were administrated 30 minutes before operation. Placing supine position on the table capable of Trendelenburg positioning, routine sterile skin painted and draped was performed. The required instruments included a zero angle videolaparoscope, a 10-mm trocar, a 5-mm trocar, grasper forceps, and a standard curled 2-cuff PD catheter. A 10-mm camera port was inserted through supra-umbilical incision which laying 3 fingerbreadths (FB) above umbilicus (Fig. 1). In previous abdominal surgery patients, 10-mm port was incised intentionally away from the previous surgical scar to prevent visual field obscured by adhesion band or omentum. Pneumoperitoneum was created by carbon dioxide insufflation which 12-15 mmHg pressure was maintained constantly during operation. The camera port was used for camera and PD catheter insertion. Diagnostic laparoscopy was performed to detect undiagnosed hernia or other pathology. A second 5-mm catheter port incision was predetermined at 2-3 centimeters inferolateral to umbilicus which mostly preferred at left paramedian. The catheter port was advanced while making a tunnel that passed through rectus sheath in a craniocaudal direction toward the pelvis and medial to inferior epigastric vessel, which can often be visualized with the laparoscope. The tunnel was 4 to 6 centimeters long before entering peritoneal cavity (Fig. 2). The rectus sheath and preperitoneal tunnel was essential in maintaining intra-pelvic alignment of the catheter. This maneuver would prevent catheter tip migration. We normally inserted PD catheter through camera port after diagnostic laparoscopy was performed (Fig. 3). Introduced via catheter port, grasper forceps were used to adjust PD catheter tip into pouch of Douglas (Fig. 4). After catheter tip was located in appropriate position, the proximal part of extra-peritoneal portion of PD catheter was grasped and prepared to pull out via catheter port (Fig. 5). While catheter port was pulling out, we grasped proximal part of extra-peritoneal portion of PD catheter and took the catheter out immediately followed the port (retrograde technique). During PD catheter was taken out gently, deep cuff of PD catheter

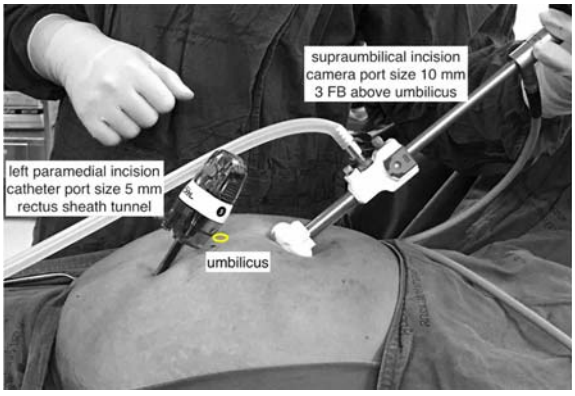

Fig. 1 Port sites for laparoscopic retrograde PD catheter insertion.

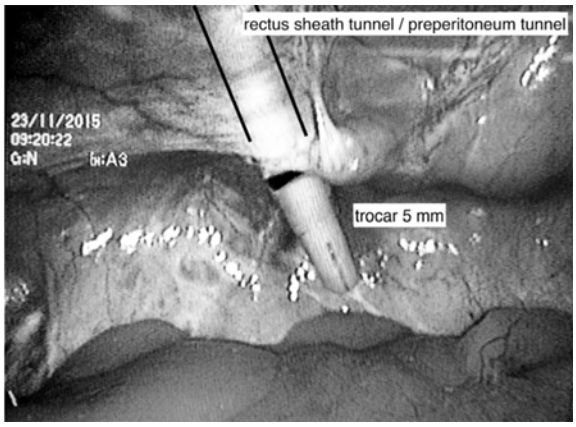

Fig. 2 Creation of rectus sheath/preperitoneum tunnel by trocar 5 mm.

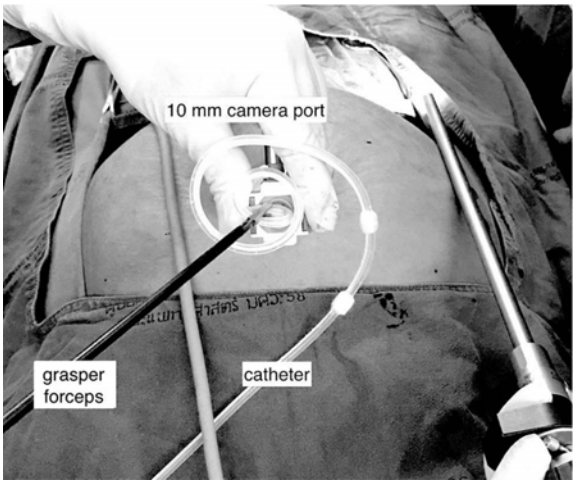

Fig. 3 PD Catheter was grasped and advanced through the camera port by grasper forceps.

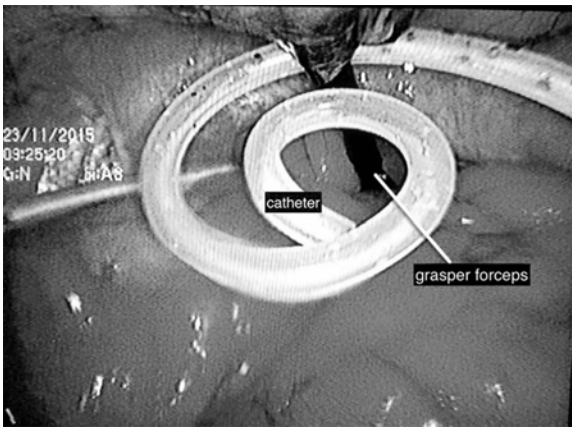

Fig. 4 Tip of PD catheter was adjusted by grasper forceps.

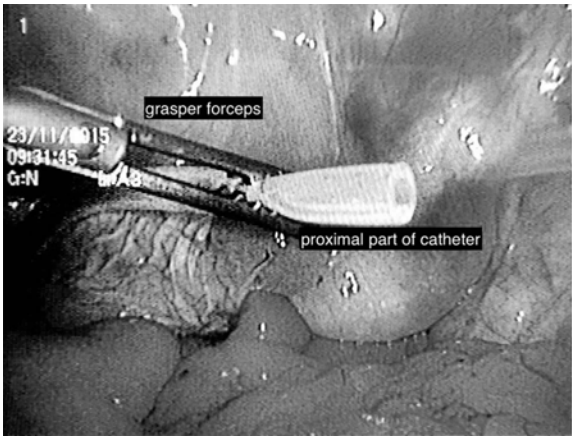

Fig. 5 Proximal part of extra-peritoneal portion of PD catheter was grasped.

was left in preperitoneal tunnel under direct vision (Fig. 6). Pneumoperitoneum was released while PD catheter and deep cuff was adjusted into muscular part of abdominal wall (Fig. 7).

The exit site was placed caudally and laterally to catheter port. Extended 1-cm skin incision was made at catheter port to liberally manipulate the position of superficial cuff and extra-peritoneal part of PD catheter (Fig. 8). Exit site was created by using tunneling stylet. The fascial part of camera port was closed by

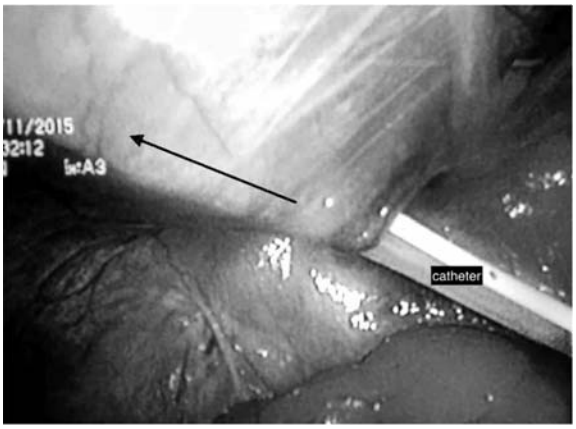

Fig. 6 PD catheter was pull out and deep cuff of was in the tunnel.

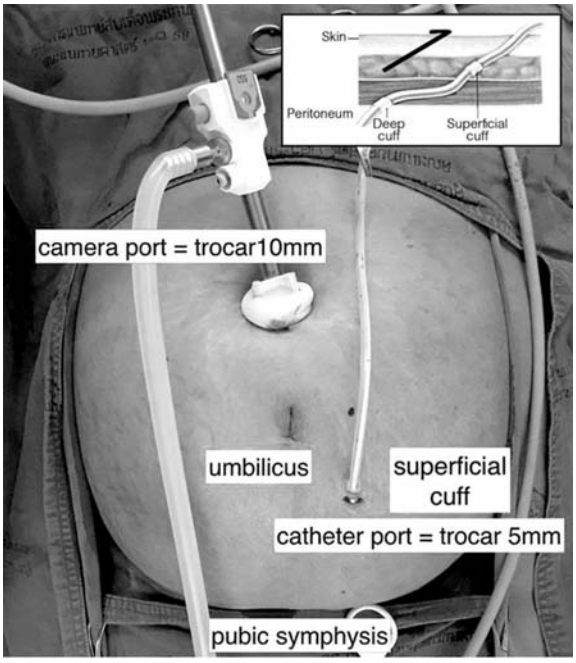

Fig. 7 Extra-peritoneal part was taken out and deep cuff was in the muscular tunnel.

interrupted suture 1-0 vicryl. Since the catheter port size was 5-mm, we only closed the subcutaneous layer and skin by absorbable suture (Fig. 9). The former lap PD insertion technique which reported previously was used 10-mm ports for the camera and catheter ports so both incisions need fascial closure[17]. Peritoneal dialysis usually started 14 days after PD catheter insertion.

Results

Eleven patients who participated into study aged range from 30-75 years; median age was 62 years old, 6 were male. Mean body mass index (BMI) was 27.58 kg/m^2. Four patients had lap PD insertion in old technique while 7 patients had r-lap PD insertion. Average operative time for both techniques without hernia repair was 30 minutes. Ten patients had previous abdominal surgery while one patient had previous laparoscopic pelvic surgery and had BMI 35.1 kg/m^2. Two patients in r-lap PD insertion had simultaneous umbilical hernia repair. Both intraoperative and immediate post-operative complications, such as hollow viscus organ injury and intra-abdominal or abdominal wall hematoma, were not observed in our techniques. Average duration of hospital stay after lap PD insertion was 1 night after operation. There was no peritonitis, exit site or tunnel infection or hernia reported. One patient who underwent r-lap PD insertion had dialysate leakage possible due to immediate dialysis, however the leakage spontaneously healed (Table 1). All patients had functional PD catheters and no catheter revision was observed. The mean follow-up period was 14 months which ranged from 1 to 36 months.

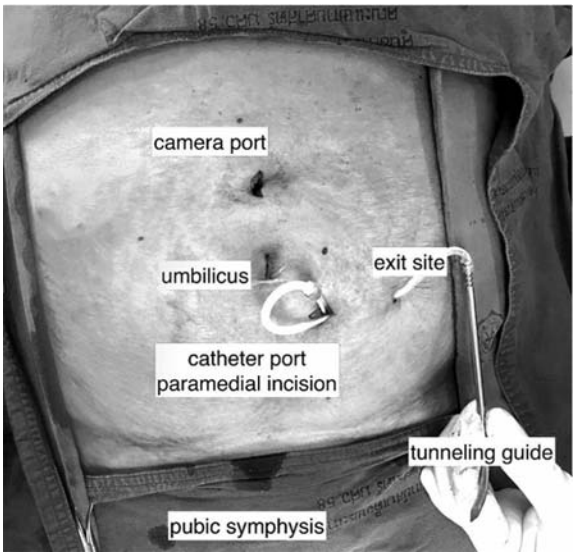

Fig. 8 Subcutaneous tunnel and exit-site.

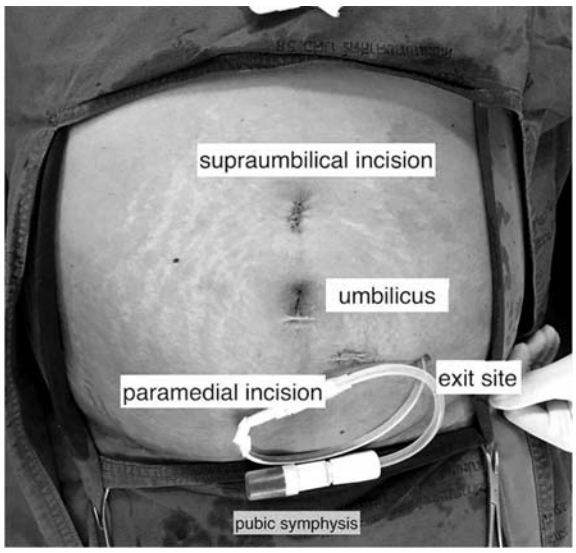

Fig. 9 After skin closure.

Discussion

Peritoneal dialysis is an important treatment of CKD patients in Thailand which resulted in increased number of PD catheter insertion over the last decade. The presented study aimed to demonstrate technique and outcome of lap PD insertion in our hospital. Mean patient ages in our study was older than reported from Ingsathit A et al[1], however the Age-Specific Prevalence increased when patients get older. Between January 2013 and March 2016, total of PD catheter insertion in our institute were 347 patients, 96.8% were achieved by minilaparotomy under local anesthesia. Lap PD insertions were performed in difficult cases, such as previous extensive abdominal operation, failed minilaparotomy PD catheter insertion, and obesity. The success of PD treatment depended on the function and endurance of PD catheter. Not only infection but mechanical obstructions; such as outflow obstruction, omental wrapping and tip migration, were main factors that terminated PD treatment[18].

Harissis HV et al[19] presented 13 lap PD insertions with catheter tip fixation by means of combination one port laparoscopy and percutaneous technique. The technique was reported as simplest, safest and least expensive than other technique. However, their tip fixation technique may cause internal intestinal hernia[20] and the PD catheter need special technique for catheter removal. Comert M et al[21] also

Table 1. Demographic data, methods and results of lap-PD and r-lap PD insertion

Variable	Laparoscopic peritoneal dialysis catheter insertion (n = 4)	Laparoscopic retrograde peritoneal dialysis catheter insertion (n = 7)
Age (year) (mean, SD)	48.75 (22.11)	59.57 (14.06)
BMI (kg/m^2) (mean, SD)	22.69 (3.16)	30.50 (2.96)
Male	4	2
Methods		
Camera and operating ports	10-mm and 10-mm ports	10-mm and 5-mm ports
PD catheter insertion technique	Via operating port	Via camera port
Preperitoneal tunnel diameter	10 mm	5 mm
Catheter placement technique	Antegrade	Retrograde
Anterior rectus sheath (entrance site)	Suture	Sutureless
Post-operative complication		
Bleeding	0	0
Bowel or bladder perforation	0	0
Leakage	0	1 (14.3%)
Peritonitis	0	0
Tunnel or exit site infection	0	0
Duration of follow-up (month) (median (min, max))	23 (6, 36)	9 (1, 11)

reported 12 patients who underwent laparoscopic PD insertion with preperitoneal tunnel fixation. Their study claimed that a 25-30 centimeters tunnel created by using Veress needle and NSS infusion will reduce tip migration and omentum wrapping. Moreover, the leakage reduced by used a 5-mm trocar which was sutureless. Though, the study found no dialysate leakage or catheter obstruction, the mean follow-up period was slightly short, 4.3 month, and there was no available data of morbidity followed preperitoneal space creation, such as hematoma and hernia formation[22]. Bircan HY et al[23] also compared lap PD insertion; Comert M technique, with open technique which had longer follow-up period. Although their study found that lap PD insertion reduced malposition, outflow obstruction, leakage and hernia with statistical significant result but the outcomes did not compare with other lap PD insertion techniques. More lap PD insertion was reported by Crabtree JH et al[16,24]. They reported 494 lap PD insertions using special 7/8-mm dilator for tunneling and insertion. After 21.6 months follow-up, only 4 patients required catheter removal from mechanical complication. Catheter flow obstruction and pericatheter leak were only found 3.7% and 2.6%, respectively. Although Crabtree's technique had impressive results, the special 7/8-mm dilator was not generally used. The r-lap PD insertion normally used one 10-mm port for both camera and PD catheter insertion. Another 5-mm port was used for making a tunnel, adhesiolysis, and taking the catheter out from the abdomen (retrograde technique). There were many advantages of our technique additional to "direct vision placement" by laparoscopy. Firstly, this maneuver created the muscular and preperitoneal tunnel which controlled PD catheter migration instead of catheter fixation by suturing and the tunnel reduced risk of cuff extrusion. The sutureless procedure permitted simple PD catheter removal. Secondly, r-lap PD insertion retrogradely pulled the PD catheter from the abdomen following the port; the technique differed from others which inserted PD catheter via the port. Therefore, we can use a 5-mm catheter port which is smaller than PD catheter for making the tunnel. This tunnel was fit by PD catheter resulted in little chance of dialysate leakage since PD catheter was tighten by the muscle. Finally, the prescribed procedure and equipment were basic and familiar to all general surgeons.

Since the presented study was preliminary study, the study had inadequate data to compare the outcomes between different PD catheter insertion techniques. However, the study purposed to present alternate technique for lap PD insertion which may assist the improvement in CKD treatment. Moreover, the mean follow-up period which was 14 months was inadequate to detected catheter malfunction. More study was required to identify the long term outcomes

of retrograde laparoscopic PD insertion.

Conclusion

Our study demonstrated the technique and outcomes of r-lap PD insertion in CKD patients. Lap PD allowed both "directed vision placement" and simultaneous intra-abdominal pathology correction. Although r-lap PD insertion had limited long term data and need further study, the presented technique was safe, simple and familiar to general surgeons and could be practiced and generalized to others. This procedure should be encouraged as an alternative PD insertion technique in complicated CKD patients, aiming to improve the standard CKD treatment over nation.

What is already known on this topic?

The previous results about lap PD insertions were mostly from westerners who had diverse techniques and outcomes. Moreover, their techniques required special instruments which were not commonly used in Thailand.

What this study adds?

The presented study reported laparoscopic retrograde PD insertion techniques which was simple and practical in Thailand. The results will expand the CKD treatment for Thais.

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Potential conflicts of interest

None.

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การวางสายสวนล้างไตทางช่องท้องแบบสวนย้อนโดยการผ่าตัดส่องกล้อง: เทคนิคและผลการผ่าตัด

ปริญญา อัครานุรักษ์กุล, ดลฤดี สองทิศ, จิรายุทธ จันทร์มา, สิริภา ช้างศิริกุลชัย

วัตถุประสงค์: *นำเสนอเทคนิคและผลการผ่าตัดการวางสายสวนล้างไตทางช่องท้องแบบสวนย้อนโดยการผ่าตัดส่องกล้องในผู้ป่วยไตวายเรื้อรัง*

วัสดุและวิธีการ: *การเก็บข้อมูลย้อนหลังในผู้ป่วยไตวายเรื้อรังที่มีความซับซ้อนในการวางสาย 11 คน ที่ได้รับการผ่าตัดวางสายล้างไตทางช่องท้องแบบปกติและสวนย้อน โดยการส่องกล้อง ณ โรงพยาบาลศูนย์การแพทย์ สมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารี ระหว่างเดือนเมษายน พ.ศ. 2556 ถึง เดือนมีนาคม พ.ศ. 2559 โดยนำเสนอเทคนิคการผ่าตัด ผลการผ่าตัดและภาวะแทรกซ้อนที่เกิดขึ้น*

ผลการศึกษา: *หลังการติดตามอาการผู้ป่วยที่ได้การวางสายล้างไตทางช่องท้องเป็นระยะเวลา 14 เดือน ไม่พบภาวะติดเชื้อ ภาวะเลือดออกหลังการผ่าตัด ภาวะไส้เลื่อน พบภาวะน้ำล้างท้องท้องมีการรั่วซึมในผู้ป่วยหนึ่งรายที่ได้รับการผ่าตัดแบบสวนย้อน เกิดเมื่อมีการล้างไตทางช่องท้องทันทีหลังผ่าตัด แต่สามารถหายได้เอง ไม่มีรายงานการเปลี่ยนตำแหน่งสายหรือการนำสายล้างไตออก*

สรุป: *เทคนิคการวางสายล้างไตทางช่องท้องโดยการส่องกล้องที่นำเสนอ ไม่ซับซ้อน ได้ผลดี และสามารถฝึกฝนได้ ถึงแม้จำนวนผู้ป่วยในการศึกษาจำกัด การผ่าตัดส่องกล้องวางสายสวนล้างไตทางช่องท้องแบบสวนย้อนควรเป็นทางเลือกสำหรับผู้ป่วยไตวายเรื่องรังที่มีความซับซ้อนในการวางสายสวน*
