นิพนธ์ต้นฉบับ

ความสัมพันธ์ระหว่างตำแหน่งออกผิวหนังของสายล้างไตและอุบัติการณ์การเคลื่อนตำแหน่งของปลายสายล้างไตที่อยู่ในช่องท้องของผู้ป่วยไตเรื้อรังที่รับการรักษาด้วยการล้างของเสียทางช่องท้อง

เผดิม แก้วจงประสิทธิ์, วรพจน์ ชุณหคล้าย, วิโรจน์ จิตต์แจ้ง, สมเกียรติ พุ่มไพศาลชัย, ณัฐพงศ์ วงศ์วัฒนาเสถียร, ธเนศ ไทยดำรงค์, เสริมสิน สินธุบดี, ชววรรธน์ โกสีย์ศิริกุล

หน่วยศัลยกรรมระบบปัสสาวะ กลุ่มงานศัลยกรรม โรงพยาบาลราชวิถี กรุงเทพ ฯ

คำสำคัญ:
ตำแหน่งออกผิวหนังสายล้างไต, การเคลื่อนตำแหน่งของปลายสายล้างไต, ผู้ป่วยไตเรื้อรังที่รับการรักษาด้วยการล้างของเสียทางช่องท้อง

บทคัดย่อ

วัตถุประสงค์: ศึกษาความสัมพันธ์ระหว่างตำแหน่งออกผิวหนังของสายล้างไตและอุบัติการณ์การเคลื่อนตำแหน่งของปลายสายล้างไตที่อยู่ในช่องท้องของผู้ป่วยไตเรื้อรังที่รับการรักษาด้วยการล้างของเสียทางช่องท้อง

ผู้ป่วยและวิธีการศึกษา: ศึกษาเปรียบเทียบย้อนหลังในกลุ่มผู้ป่วยไตเรื้อรังระยะสุดท้าย ที่รับการรักษาด้วยวิธีล้างของเสียทางช่องท้องต่อเนื่อง ในโรงพยาบาลราชวิถี ตั้งแต่มกราคม พ.ศ. 2550 ถึง เมษายน พ.ศ. 2558 ข้อมูลที่ศึกษา ได้แก่ ข้อมูลทั่วไปของผู้ร่วมวิจัยประวัติผ่าตัดช่องท้องภาวะการเดินหรือเคลื่อนที่ตำแหน่งสายล้างไตทางช่องท้องจากภาพรังสีหลังผ่าตัด ผลแทรกซ้อนของการล้างไต เช่น สายเคลื่อนตำแหน่งสายอุดตันการรั่วของน้ำยาล้างไตทางแผลหน้าท้องอาการปวดจากการใส่น้ำยาล้างไต ตลอดจนการผ่าตัดแก้ไขภาวะแทรกซ้อนดังกล่าว และข้อมูลเชิงกลของการใส่น้ำยาล้างไต ภายใน 6 เดือน หลังได้รับการผ่าตัดวางสายล้างไตทางช่องท้อง

ผลการศึกษา: ผู้ป่วยไตเรื้อรังระยะสุดท้ายที่รับการรักษาด้วยวิธีล้างของเสียทางช่องท้องต่อเนื่อง จำนวน 172 ราย จากการศึกษา ไม่พบความสัมพันธ์ระหว่างตำแหน่งออกผิวหนังของสายล้างไตกับการเกิดการเคลื่อนตำแหน่งของปลายสายล้างไตที่อยู่ในช่องท้อง โดยพบว่า การวางสายล้างไตไว้ในเชิงกรานด้านซ้าย มีอุบัติการณ์การเคลื่อนตำแหน่งของปลายสายลดลงอย่างมีนัยสำคัญทางสถิติ อย่างไรก็ตาม ไม่พบความแตกต่างเรื่องสายล้างไตทำงานขัดข้องในด้านอื่นๆ มีผู้ป่วย 34 ราย (ร้อยละ 19.2) ต้องรับการผ่าตัดแก้ไขปัญหาสายทำงานขัดข้องภายใน 6 เดือน

สรุป: อุบัติการณ์การผ่าตัดเพื่อแก้ไขสายล้างไตที่ทำงานไม่ปกติ พบร้อยละ 19.2 โดยไม่พบความสัมพันธ์ระหว่างตำแหน่งออกผิวหนังของสายล้างไต กับการเคลื่อนที่ของปลายสายล้างไตที่อยู่ในช่องท้องของผู้ป่วยไตเรื้อรังที่รับการรักษาด้วยการล้างของเสียทางช่องท้อง การวางสายล้างไตไว้ในเชิงกรานด้านซ้าย พบอุบัติการณ์การเคลื่อนตำแหน่งของปลายสายได้อย่างมีนัยสำคัญทางสถิติ

ผู้นิพนธ์หลัก: เผดิม แก้วจงประสิทธิ์ หน่วยศัลยกรรมระบบปัสสาวะ กลุ่มงานศัลยกรรม โรงพยาบาลราชวิถี
E-mail: phaderm.k2@gmail.com

Original article

Association of exit site of peritoneal dialysis catheter and catheter tip migration in continuous ambulatory peritoneal dialysis patients

Phaderm Kaewjongprasit, Vorapot Choonhaklai, Viroj Chittchang, Somkiat Pumpaisanchai, Nattapong Wongwattanasatien, Tanet Thaidumrong, Sermsin Sindhubodee, Chawawat Gosrisirikul

Division of urology, Department of surgery, Rajavithi Hospital, Bangkok, Thailand

Keywords:
exit site, peritoneal dialysis catheter, catheter tip migration, CAPD

Abstract

Objective: To identify correlations between locations of exit site and incidence of catheter tip migrations, in end stage renal disease (ESRD) patients who obtained continuous ambulatory peritoneal dialysis (CAPD).

Materials and methods: Between January 2007 and April 2015, ESRD patients who underwent CAPD in Rajavithi hospital were enrolled in retrospective study. The data for analysis included; patient demographic, abdominal surgery history, ambulatory status, position of catheter from postoperative radiography, complications of CAPD, which were classified as migrations, obstructions, peritonitis, pericatheteric leakages, drain pains, revision or removal surgery, mechanical data of dialysate infusions within 6 month after surgery, infection rates of tissue bed or surgical wound in kidney transplantation were collected and analyzed for risk factors of catheter related complications using univariate and multivariate analysis.

Results: There were 172 patients who underwent CAPD, 113 patients had exit site on the left side of abdomen and 59 patients had the right exit site. In right exit site group, 21 (35.6%) patients had catheter tip migration, while in left exit site group 38 (33.6%) patient had catheter tip migrations. No correlations between exit site locations and incidence of catheter tip migrations (p=0.797). But, left sided intrapelvic position of catheter is associated with lower risk catheter tip migrations (OR 0.36, 95% CI 0.16-0.78, p=0.008). Other catheter related problems were not different between the two groups. Thirty-three (19.2%) patients needed revision or removal surgery within 6 month

Conclusion: Incidence of revision or removal surgery was 19.2 %. However, there is no correlations between exit site of abdomen and catheter tip migrations. The study show that the Left intrapelvic catheteral placement has lower incidence of catheter tip migrations.

Corresponding author: Phaderm Kaewjongprasit, Division of urology, Department of surgery, Rajavithi Hospital, Bangkok, Thailand

E-mail: phaderm.k2@gmail.com

Introduction

Acceleration of newly arrived chronic kidney disease (CKD) patients has impact on world's health care systems. In Thailand, the ministry of public health reported new case of CKD patients 10-15% annually and related to cause of death at 6th ranking during 10-year periods (1997-2007)[1]. Chronic kidney disease is state of irreversible change of destructed nephrons, affecting filtrations, electrolyte regulations and hormonal productions. Pathophysiology of CKD is coherent with parenchymal abnormality, infections, post renal obstructions, renovascular and metabolic disturbances. Renal functions can be assessed by serum creatinine for calculating glomerular filtration rate (GFR). Patients who had GFR below 15 are diagnosed as end stage renal disease (ESRD), and need long term renal replacement therapy (RRT)[2].

The options of RRT consists of hemodialysis, continuous ambulatory peritoneal dialysis (CAPD) and kidney transplantation (KT). CAPD is more popular in developed countries. The advantages include ability of performed treatment themselves, lower medical costs, minimal food or water restrictions, better blood pressure controls and no disturbance of daily activities. The disadvantages are risk of infections and catheter related problems[3]. Some studies show factors linked to catheter related problems of CAPD. Hagen[4] reported that intraperitoneal configuration of catheter, numbers of cuff and subcutaneous tract contour did not affect incidence of catheter malfunctions. In contrast, Gadallah[5] found that 2 cuffed swan neck curled end catheter have low incidence of catheter malfunctions, while, Nielsen[6] found that curled end catheter had lower rate of catheter tip migration compared with straight end at 1 year follow up. However, Li[7] found that 2 cuffed straight end with artificial subcutaneous swan neck placement had lower risk of exit site infection and catheter malfunctions.

There were only few studies for the exit sites. Lan[8] reported that location of exit site were related to catheter malfunctions, but results were unclear. So we conducted a retrospective study to identify correlation between exit site location, incidence of catheter tip migration and other catheter related complications in patient who obtain CAPD.

Materials and methods

The study was conducted from January 2007 to April 2015 in retrospective designs. Patients who receive CAPD therapy in Rajavithi hospital were enrolled.

Inclusion criteria were as follow:

(1) ESRD patient who were candidate for RRT which documented by nephrologist
(2) No contraindication for peritoneal dialysis (PD) catheter placement as defined by Shetty A[9]
(3) ESRD patient who had complete dialysate mechanical data and post-surgical imaging
(4) ESRD patient who had adequate follow-up periods.

All demographic data, abdominal surgery history, ambulatory status, locations of intraperitoneal segment and exit site of catheter from postoperative imaging, mechanical complications of CAPD catheter, infection rates of tissue bed and surgical wound in KT procedures were recorded. The study was approved by the ethics and research committee of Rajavithi hospital.

Patients were categorized into two groups according to locations of exit site. All patients underwent PD catheter placement in open traditional technique with midline approach. Routine preoperative preparations include skin preparation and prophylactic antibiotic administration within 1 hour before surgery. Patients' blood pressure, heart rate and blood oxygen saturation level were monitored in operating room. Patient were placed in supine position. Surgical field were cleaned with sterile method and the operation

performed under local anesthesia with 2% lidocaine without adrenaline. The procedures were conducted by 2nd to 3rd year urologic residents of the division of urology, department of surgery, Rajavithi hospital. Four-cm vertical infraumbilical incision was made at midline. Subcutaneous tissue was dissected until exposed anterior rectus sheath. After the sheath was incised, peritoneum was identified and small incision was made. Then, a 2 cuffed straight curled end catheter 15 Fr in size and 57.5 cm in length under blunt stiffening metal stylet guidance was advanced into Cul de sac. Functions of catheter was checked by instillation of 50 ml of saline. Inner cuff was fixed onto peritoneal membrane and posterior rectus sheath by purse-sting suture technique. Anterior rectus sheath was sutured upward which made inner cuff secured inside rectus abdominis muscle. Subcutaneous tunnel was made in cephalolateral directions on either side of abdomen. Outer cuff was placed in subcutaneous tissue proximal to exit site 2 cm, then subcutaneous tissue and skin was closed. Finally, heparinized saline were applied into PD catheter for preventing clot formations.

In postoperative follow up, we checked position of PD catheter from abdominal radiography on the next day. Peritoneal fluid instillation began 1 week after surgery. The dialysate inflow time, outflow time and ultrafiltration were recorded in each IPD treatment and OPD visit. During 6 month follow up periods, all complications that occur at CAPD clinics or IPD were recorded. For term of catheter tip migrations, the criterion is >50% area of curl end of PD catheter had located above imaginary line drawn between anterior superior iliac spine (ASIS) from abdominal radiography. The patients who had at least 1 episode of catheter tip migrations were categorized in migratory group. Abdominal imaging could be repeated if clinical of catheter tip migrations were suspected

Data are shown as percentage or mean with standard deviation values. Predictors of catheter tip migration and other catheter related problems were identified with univariate analysis, followed by multivariate analysis.

The statistical analysis software was Statistical Package for Social Sciences (SPSS) version 17.0. Descriptive statistic was shown as number, percentage, mean, median, standard deviations. About inferential statistics, Quantitative information comparing use the Student T-test with normal distribution data and the Mann-Whitney U test with non-normal distribution. Qualitative information comparing use the Chi-square test. The p-value less than 0.05 was considered to indicate statistical significant.

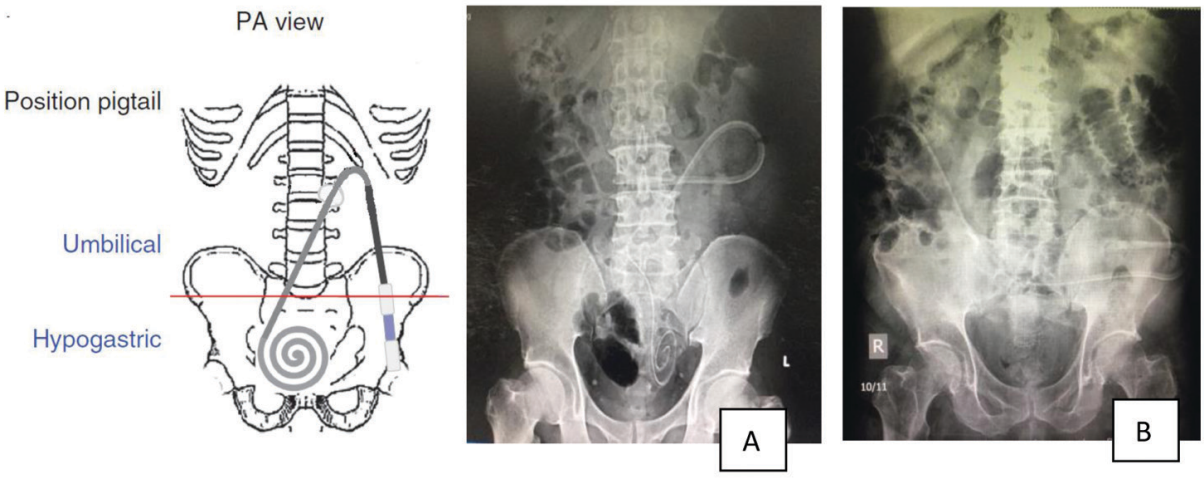

Figure 1 Location of catheter tip from abdominal radiography (A) non migration (B) migration

Results

There were 261 ESRD patients receiving CAPD therapy who were met eligible criteria, but 89 patients had incomplete information. Therefore, 172 patients had enrolled for the study. (Fig.2)

The baseline characteristics of patients who received CAPD therapy classified on exit site locations showed in Table 1. There were 55 men and 58 women in left exit site group, and 20 men and 39 women in right exit site group without significant differences between two groups (p=0.064). The mean age was 62.6+12.2 years old in left exit site group without significant difference from right exit site group (59.8+16.2 years old) (p=0.253), also no difference

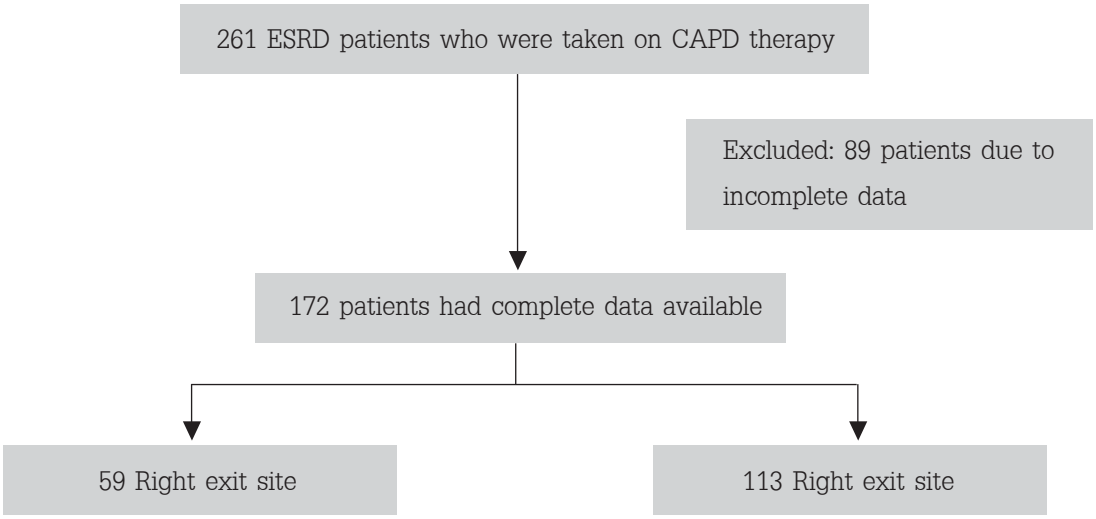

Figure 2 Flows of the patients

Table 1 The patients' characteristics.

Characteristics	Left exit site (n=113)	Right exit site (n=59)
Sex, n (%)		
Male	55 (48.7%)	20 (33.9%)
Female	58 (51.3%)	39 (66.1%)
Mean (SD) age, years	62.6 (12.2)	59.8 (16.2)
Mean (SD) BMI, kg/m^2	25.76 (4.54)	23.54 (4.36)
Comorbid	5 (9.09%)	1 (1.15%)
Hypertension	68 (60.2%)	36 (61.0%)
Diabetes Mellitus	45 (39.8%)	25 (42.4%)
Cerebrovascular accident	7 (6.2%)	5 (8.5%)
Coronary artery disease	11 (9.7%)	5 (8.5%)
Previous abdominal surgery	2 (1.8%)	0 (0.0%)
Bed ridden	5 (4.4%)	2 (3.4%)

in body mass index (BMI) (p=0.257). Patient comorbid were assorted in hypertension (HTN), diabetes mellitus (DM), cerebrovascular accident (CVA) and coronary artery disease (CAD), there were no difference between 2 groups. In left exit site group, 2 patients had undergone postpartum sterilizations. For ambulatory status, 5 patients in left exit site and 2 patient in right exit site were bed ridden. No patient had undergone kidney transplant operation in our study.

Catheter related problems and mechanical data of dialysate infusions were shown in Table 2 and 3. We did not find significant difference in all components of catheter related problem which classified as migrations, obstructions, peritonitis, pericatheteric leakages, drain pains, revision/removal surgery and all mechanical data of dialysate infusion as inflow time, outflow time and ultrafiltration between 2 groups which classified on location of exit site. There were 33 patients who needed revision or removal surgery in the study (19.2%).

During the data analysis, we noticed that left intrapelvic location had fewer catheter tip migrations than right intrapelvic location. (p=0.008). The others catheter related problems were not differences between 2 groups. The data were shown in table 4.

The correlation between of exit site and intrapelvic location in our study, we found that it did not related to each other (p=0.218). Data was shown in table 5

Table 2 Catheter related complications contributed to exit site location.

Complications	Left exit site (n=113)	Right exit site (n=59)	p-value
Migrations	38 (33.6%)	21 (35.6%)	0.797
Obstructions	18 (15.9%)	9 (15.3%)	0.908
Peritonitis	15 (13.3%)	10 (16.9%)	0.516
Pericatheteric leakage	5 (4.4%)	6 (10.2%)	0.190
Drain pain	0 (0.0%)	1 (1.7%)	0.343
Revision/Remove	24 (21.2%)	9 (15.3%)	0.344

Table 3 Mechanical data of dialysate infusions contributed to exit site location.

Complications	Left exit site (n=113)	Right exit site (n=59)	p-value
Mean(SD) Dialysate inflow, min	11.54 (2.64)	11.10 (3.37)	0.492
Mean(SD) Dialysate outflow, min	17.77 (6.13)	16.03 (6.20)	0.167
Mean(SD) Ultrafiltration, ml	922.22 (416.97)	1000.00 (494.62)	0.386

Table 4 Catheter related complications contributed to intrapelvic location of catheters.

Complications	Intrapelvic LLQ (n=51)	Intrapelvic RLQ (n=121)	p-value
Migrations	10 (19.6%)	49 (40.5%)	0.008*
Obstructions	4 (7.8%)	23 (19.0%)	0.066
Peritonitis	7 (13.7%)	18 (14.9%)	0.845
Pericatheteric leakage	6 (11.8%)	5 (4.1%)	0.086
Drain pain	1 (2.0%)	0 (0.0%)	0.297
Revision/Remove	6 (11.8%)	27 (22.3%)	0.109

Table 5 Correlation of exit site and intrapelvic location of peritoneal dialysis catheter.

Position of catheters	Left exit site (n=113)	Right exit site (n=59)	p-value
Left intrapelvis (n=51)	30 (26.5%)	21 (35.6%)	0.218
Right intrapelvis (n=121)	83 (73.5%)	8 (64.4%)	

Discussion

Catheter tip migration is a common complication related to PD catheter placement, leading to CAPD failure. Many surgeons were eager to prevent this phenomenon. Either by configuring catheters or improvement in surgical techniques, such as fixing intraabdominal segment of the tube to abdominal wall[10]. But, incidences of catheter tip migration were still high.

The goals of this study were to find out the way to reduce occurrences of surgical repositioning. Results of the study, Lan[8] stated that location of exit site were related to catheter malfunction, but with unclear results. Our study gave incongruous results. No correlation between exit site location and all component of catheter related complications and all component in mechanical dialysate infusions.

Interestingly, our study found that position of intrapelvic segment affected chance of catheter tip migration, but did not affect the other, regarding obstruction, peritonitis, pericatheteric leakage, drain pain and revision or removal surgery. Major mechanisms were likely from colonic isoperistalsis when curled end were placed in left side of intrapelvis. If the catheter traveled to splenic flexure, it could be drawn down spontaneously when patient ambulated, got laxative for creating smooth stool or promotion of intestinal peristalsis by massaging lower abdomen. Another reason is effect of sigmoid colon. When curled end of PD catheter was placed in left side intrapelvis, it was trapped by bladder wall and sigmoid colon. So, the results of our study suggested that placing the tip of the catheter into left side of intrapelvic cavity under direct vision with or without adjunct intraoperative fluoroscopy might lesser catheter tip migration.

We did not found associations between exit site location and intrapelvic position of catheter. Left side intrapelvic positions of catheter had right exit site about 36%. Thus, the surgeons could create exit site at left paraumbilicus while placing catheter tip into left side of pelvis concomitantly. Because living kidney

donor usually offer left kidney if they had both healthy kidney. Creating exit site and catheter tip this way should be more appropriate for future transplantation of the donor kidney.

The limitation of this study should be highlighted. First, due to its retrospective design, some data were missing. Second, the sample size was small, and the correlation of some variables could have reached statistical significance if more patients had been included. Third, a large multicenter prospective study would be mandatory to ensure adequate collection of data to perform multivariate analyses in a larger number of patients, and provide external validation to our results.

Conclusion

Incidence of revision or removal surgery was 19.2%. However, there is no correlations between exit site of abdomen and catheter tip migrations. The study show that the Left intrapelvic catheteral placement has lower incidence of catheter tip migrations.

References

1. Mortality rates by leading cause of deaths per 100,000 populations in 1997-2007. Bureau of Policy And Strategy, Office of the Permanent Secretary of Ministry of Public Health, Thailand. http://bps.moph.go.th/new_bps
2. National Kidney Foundation. KDOQI clinical practice guideline for hemodialysis adequacy: 2015 update. Am J Kidney Dis 2015;66(5):884-930.
3. Crabtree JH. Peritoneal dialysis catheter implantation: Avoiding problems and optimizing outcomes. Seminars in Dialysis 2015;8(1): 12-15.
4. Hagen SM, Lafranca JA, IJzermans JNM, et al. A systematic review and meta-analysis of the influence of peritoneal dialysis catheter type on complication rate and catheter survival. Kidney International 2014;85:920-932.
5. Gadallah MF, Mignone J, Torres C, et al. The role of peritoneal dialysis catheter configuration in preventing catheter tip migration. Adv Perit Dial 2000;16:47-50
6. Nielsen PK, Hemmingsen C, Friis SU, et al. Comparison of straight and curled Tenckhoff peritoneal dialysis catheter implant by percutaneous technique: A prospective randomized study. Perit Dial Int 1995;15:18-21.
7. Li CL, Cui TG, Gan HB, et al. A randomized trail comparing conventional swan neck straight-tip catheter from straight-tip catheter with a artificial subcutaneous swan neck. Perit Dial Int 2009;29:278-284.
8. Lan L, Jiang J, Wang P, et al. Peritoneal dialysis catheter placement in the right lower quadrant is associated with a lower risk of catheter tip migration: a retrospective single-center study. Int Urol Nephrol 2015;47:557-562.
9. Shetty A, Oreopoulos G. Peritoneal dialysis: Its indications and contraindications. Dialysis & Transplantation 2000;29:71-77.
10. Chen WM, Cheng CL. A simple method for prevent peritoneal dialysis catheter tip migration. Perit dial int 2007;27:554-556.