The Effects of Peritoneal Dialysis Catheter Insertion using Paramedian versus Midline Approach on CAPD Patients

Chavasak Kanokkantapong MD*,
Napat Leeaphorn MD**, Talerngsak Kanjanabuch MD**

** Division of Nephrology, Department of Medicine, Maharat Nakhonratchasima Hospital, Nakhonratchasima, Thailand*
*** Division of Nephrology, Department of Medicine and Kidney & Metabolic Research Center, Faculty of Medicine, Chulalongkorn University and King Chulalongkorn Memorial Hospital, Bangkok, Thailand*

Objective*: Types of peritoneal dialysis (PD) catheter design and catheter insertion techniques have been shown to affect catheter-associated infection, catheter survival, as well as, overall patient survival. Thus far, there have been no studies demonstrating a difference in long term outcome between two insertion techniques used for PD placement, including midline and paramedian incisions. The present study was conducted to compare clinical outcomes among CAPD patients who had bedside PD catheter insertion through midline incision vs. paramedian incision in terms of early post-operative complications and long term outcomes.*

Material and Method*: This is a retrospective study. All CAPD patients who received treatments at Maharat Nakhonratchasima Hospital during the year 2008-2010 were included in the present study. Age, sex, co-morbid diseases, laboratory results obtained prior to dialysis, early post-operative complications, and late post-operative complications were documented.*

Results*: A total of 392 patients were identified. Of these, 43 patients were excluded due to incomplete medical records. The remaining 349 cases were collected for analysis, 90 cases having paramedian incision and 259 cases having midline incision. The average age was 51.7 years old, and 52% were male. The baseline characteristics and patient parameters were similar in both approaches. The paramedian group was found to have lesser early post-operative complications (7.78%) when compared to the midline group (18.82%) ($p = 0.02$). Moreover, the long term outcomes were shown to be greater in paramedian approach when compared to the midline group in terms of PD catheter survival (985.5 vs. 698.1 days, $p = 0.048$) and overall patient survival (915.4 vs. 700.6 days, $p = 0.01$). However, there was no significant difference in peritonitis-free survival (848.7 vs. 824.3 days, $p = 0.93$).*

Conclusion*: Comparing PD catheter insertion using paramedian incision with midline incision, paramedian incision was associated with less early post operative complications, more prolonged PD catheter survival and better overall patient survival. Therefore, paramedian incision should be recommended as the preferred method for PD catheter insertion.*

Keywords: *PD Catheter insertion, Paramedian incision, Midline incision, Outcome, Peritonitis-free survival*

J Med Assoc Thai 2011; 94 (Suppl. 4): S52-S57
Full text. e-Journal: *http://www.mat.or.th/journal*

Peritoneal dialysis (PD) expands rapidly in Thailand since 1st November 2008, the time "PD First" Policy was launched by the National Health Security Office and Ministry of Public Health. This policy allows end stage renal disease patients under universal health coverage scheme to be treated with CAPD without their own stipend. Therefore the number of PD population is tripling and the naive service center is recruited recently. In order to reduce the line of waiting list for catheter insertion, the bedside or ambulatory percutaneous PD catheter insertion become widely used in many centers of Thailand. The bedside procedure can be performed in out-patient setting under local anesthesia; it is less time consuming and less expensive than surgical procedure. However, the bedside procedure may not be suitable for complex cases, such as patients with multiple previous abdominal surgeries or obese patients with thick abdominal wall, in light of possible intra-abdominal organ injury[1,2].

There are two sites that are commonly chosen for PD catheter insertion. The first is located

Correspondence to:
Kanjanabuch T, Division of Nephrology, Department of Medicine and Kidney & Metabolic Disorders Research Center, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.
Phone: 0-2256-4321 ext. 211
E-mail: golfnephro@hotmail.com

approximately 2 cm below the umbilicus (midline approach) and the another is located 3 cm below and lateral to umbilicus through the rectus muscle (paramedian approach[3,4]. Catheter insertion at midline incision promotes easier access to the peritoneal cavity due to a thinner layer of abdominal muscle and lower vascularization at the midline site. On the other hand, paramedian approach could provide more stabilized deep cuff fixation, minimizes the risk of malposition, herniation, and peri-catheter leakage because the wound is reinforced by highly vascularized strong rectus muscle, in comparison to the poorly vascularized linear alba in the midline approach[3,5,6]. Moreover, the site of paramedian approach is located lower than the median, thus the incidence of omental wrapping should hypothetically be less. All these anatomical advantages of paramedian approach described above theoretically decrease the chance of peri-catheter leakage, catheter malposition, and catheter obstruction. However, there have been no studies so far that demonstrate the superiority of the paramedian insertion in the incidence of catheter-related infection and mechanical catheter failures[7-10].

Maharat Nakhonrachasima Hospital is a large regional medical center that serves many CAPD patients under the care of 4 board-certified nephrologists. The bedside catheter insertion technique is performed in almost all CAPD patients at this center. The insertion of choice for each patient (midline or paramedian approach) depends upon physician's preference and consideration. To prevent leakage, CAPD is not initiated until at least 2 weeks after catheter insertion. If peri-catheter leakage or catheter malposition occurs, catheter removal and simultaneous reinsertion will be performed. Then patients will have to wait for 2 more weeks before the dialysis begins.

To compare clinical outcomes among CAPD patients who had midline incision versus paramedian incision. The clinical outcomes comprised early post-operative complications and long term outcomes. Early post-operative complications were classified into 2 categories: catheter-related infection and mechanical catheter failure. Long term outcomes were measured in terms of peritonitis-free survival, peritoneal dialysis catheter survival, and overall patient survival.

Material and Method

Design

The present was a non-randomized retrospective cohort study.

Patients

From January 1, 2008 to December 31, 2010, all CAPD patients older than age 15, who received treatment at Maharat Nakhonratchasima Hospital were included in the present study. After chart reviews, patients with incomplete medical record were excluded.

Statistical analysis

Data were reported and summarized as mean, standard deviation, and percentages. Survival was recorded using Kaplan-Meier survival methods. Chi-square test and Log-rank test were used for statistical analysis where appropriate.

Results

A total of 392 patients were identified. Of these, 43 patients were excluded due to incomplete medical records. The remaining 349 cases were collected for analysis, 90 cases had paramedian incision and 259 cases had midline incision (Table 1). The average age was 51.7 years old. The average weight, height, and BMI were 57.5 kg, 159.9 cm, and 22.5 kg/m^2, accordingly. The proportions of cases with co-morbid diseases were as follows: diabetes mellitus 28.9%, hypertension 58.5%, diabetes mellitus and hypertension 27.5%. The majority of patients (57.5%) were elementary school graduates, 67.7% of patients could not perform the dialysis by themselves, hence required the help from family members.

Early post-operative complications (Table 2)

Catheter-related infection occurred in 3 cases: 1 case (1.11%) in the paramedian and 2 cases (0.77%) in the midline group, but the difference was not statistically significant. Mechanical catheter failure occurred in 53 cases: 6 cases (6.67%) in the paramedian group and 47 cases (18.15%) in the midline group. The difference of mechanical catheter failure between two groups was statistically significant ($p = 0.04$). When combined all early post-operative complications together, there were a total of 7 cases (7.78%) in the paramedian group versus 49 cases (18.92%) in the midline group. The difference between two groups was statistically significant ($p = 0.02$).

Long term outcomes

Sixteen cases in the paramedian group had peritonitis. The peritonitis-free survival was 848.7 $\pm$ 52.9 days. In the midline group, there were 49 cases that had peritonitis and the peritonitis-free survival was 824.8 $\pm$ 30.7 days. However, there was no statistically

Table 1. Patient characteristics and laboratory results obtained prior to dialysis, demonstrated in mean ± standard deviation and percentage

Characteristics	Catheter implantation techniques			p-value
	Para-median (90)	Midline (259)	Total (349)	
Age (years)	54.2 ± 13.7	50.9 ± 16.2	51.7 ± 15.6	0.08
Male (%)	40 (44.4)	140 (54.4)	194 (52)	0.14
Weight (kg.)	58.5 ± 13.5	57.1 ± 11.7	57.5 ± 12.2	0.48
Height (cm.)	158.9 ± 9.0	160.3 ± 9.0	159.9 ± 9.0	0.30
Body mass index (kg/m^2)	23.2 ± 4.6	22.2 ± 3.8	22.5 ± 4.0	0.16
Co-morbidities				
Diabetes mellitus (DM)	31 (34.4)	70 (27.0)	101 (28.9)	0.22
Hypertension (HT)	57 (63.3)	139 (53.7)	196 (56.2)	0.14
DM & HT	30 (33.3)	66 (25.5)	96 (27.5)	0.17
Educational levels				
Elementary	58 (64.4)	141 (54.4)	199 (57.0)	0.35
Secondary	12 (13.3)	38 (14.7)	50 (14.3)	
Bachelor	3 (3.3)	9 (3.5)	12 (3.4)	
Data unavailable	17 (18)	71 (27.4)	88 (25.2)	
Dialysis				
Family-assisted	67 (74.4)	171 (66)	256 (67.9)	0.17
Self care	23 (25.6)	88 (34)	121 (32.1)	
Laboratory results prior to dialysis				
Serum albumin(g/dL)	3.4 ± 0.5	3.2 ± 0.5	3.3 ± 0.5	0.68
Hematocrit (%)	25.5 ± 6.1	24.4 ± 5.6	24.7 ± 5.7	0.10
Hemoglobin (g/dL)	8.5 ± 1.8	8.2 ± 2.4	8.3 ± 2.3	0.26
Blood urea nitrogen (mg/dL)	65.9 ± 45.3	72.5 ± 51.5	70.8 ± 49.9	0.28
Serum creatinine (mg/dL)	10.7 ± 5.9	11.6 ± 6.1	11.3 ± 6.0	0.22
Serum calcium (mg/dL)	8.6 ± 1.3	8.7 ± 3.0	8.7 ± 2.7	0.60
Serum phosphate (mg/dL)	5.7 ± 3.4	5.6 ± 2.8	5.6 ± 3.0	0.74

Table 2. Early post-operative complications, demonstrated in number of cases (percentage)

Complications	Paramedian approach (n = 90)	Midline approach (n = 259)	p-value
Catheter-related infection	1 (1.11)	2 (0.77)	0.71
Mechanical failure	6 (6.67)	47 (18.15)	0.04
Total	7 (7.78)	49 (18.92)	0.02

significant difference between the two groups (p = 0.93, Log-rank test) (Fig. 1).

The average PD catheter survival in the paramedian group was 948.85 ± 42.5 days. There were 28 patients in this group who terminated CAPD treatments. The average PD catheter survival in the midline group was 698.1 ± 33.8 days. There were 142 patients in this group who terminated CAPD treatments. The difference between two groups was statistically significant (p = 0.048, Log-rank test) (Fig. 2).

The average overall patient survival was 915.4 ± 41.6 days in the paramedian group versus 700.6 ± 33.4 days in the midline group. The difference was statistically significant between the two groups (p = 0.01, Log-rank test) (Fig. 3).

Discussion

The present study showed that PD catheter insertion using paramedian incision could decrease early post-operative complications. Moreover, the use of paramedian incision could improve long term outcomes in terms of PD catheter survival and overall

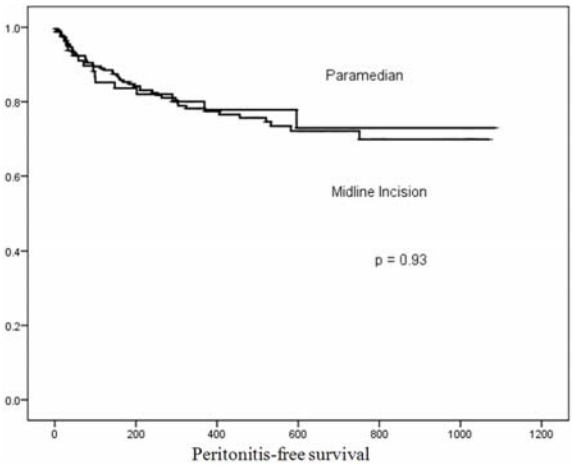

Fig. 1 Peritonitis-free survival

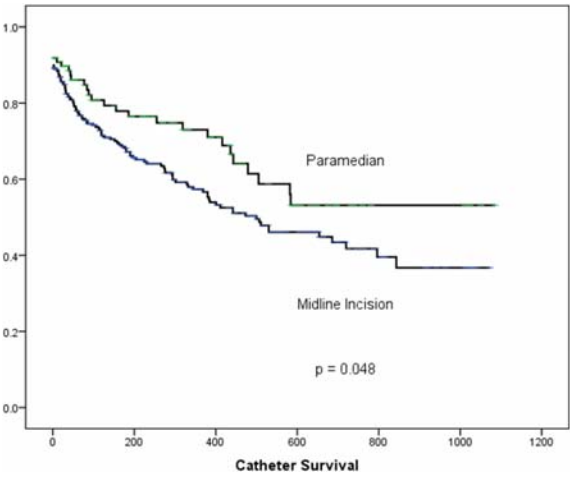

Fig. 2 Catheter survival

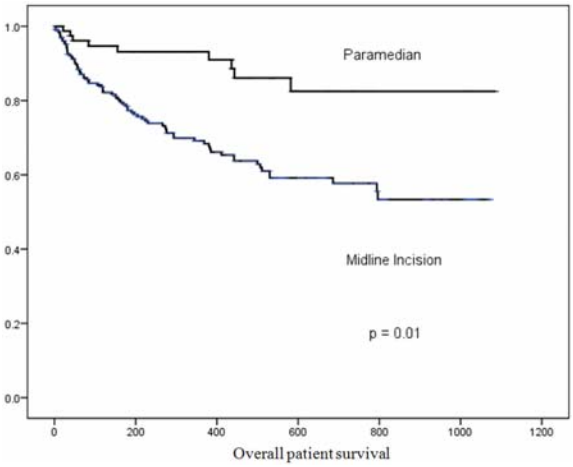

Fig. 3 Overall patient survival

patient survival, but failed to show any difference in peritonitis-free survival when comparing midline and paramedian insertion.

Previous studies[7-10] found no differences in both mechanical catheter failure and peritonitis when comparing midline and paramedian insertion. In the present study, the authors concluded that paramedian approach can decrease the rate of mechanical catheter failure, which results in improved catheter survival and overall patient survival. However, the insertion sites apparently have no effect on catheter-related infection and peritonitis-free survival. These two later findings are concordant with the previous studies[7-10].

Since the present study was not a randomized clinical trial, there were many factors that were not controlled and recorded. These factors (such as the type of catheter used, catheter insertion techniques, individual judgment and preference on selection of insertion site in each nephrologist, and so forth) might affect the clinical outcomes and caused errors in the present study.

The risks of injuring the inferior epigastric artery is higher with the paramedian approach[11,12], but did not occur in the present study.

In conclusion, PD catheter insertion using paramedian approach is safe with low complication rates. This approach appears to be better than the median insertion method, particularly in reducing the risk of catheter mechanical failure, improving long term catheter survival and overall patient survival. Therefore, paramedian incision should be recommended as the preferred method for PD catheter insertion.

Potential conflicts of interest

None.

References

1. Figueiredo A, Goh BL, Jenkins S, Johnson DW, Mactier R, Ramalakshmi S, et al. Clinical practice guidelines for peritoneal access. Perit Dial Int 2010; 30: 424-9.
2. Flanigan M, Gokal R. Peritoneal catheters and exit-site practices toward optimum peritoneal access: a review of current developments. Perit Dial Int 2005; 25: 132-9.
3. Lee HB, Park MS, Cha MK, Kim JH, Song KI, Moon C. The peritoneal access. Perit Dial Int 1996; 16 (Suppl 1): S322-6.
4. Gokal R, Alexander S, Ash S, Chen TW, Danielson A, Holmes C, et al. Peritoneal catheters and exit-site practices toward optimum peritoneal access:

1998 update. (Official report from the International Society for Peritoneal Dialysis). Perit Dial Int 1998; 18: 11-33.
5. Cruz C. The peritoneal dialysis catheter. Semin Dial 1995; 8: 103-4.
6. Lo WK, Cheung WC, Chan TM, Lo CY, Lui SL, Cheng IKP. Result of lower paramedian insertion of Tenckhoff catheter. J Hong Kong Med Assoc 1992; 44: 159-63.
7. Ejlersen E, Steven K, Lokkegaard H. Paramedian versus midline incision for the insertion of permanent peritoneal dialysis catheters. A randomized clinical trial. Scand J Urol Nephrol 1990; 24: 151-4.
8. Rubin J, Didlake R, Raju S, Hsu H. A prospective randomized evaluation of chronic peritoneal catheters. Insertion site and intraperitoneal segment. ASAIO Trans 1990; 36: M497-500.
9. Strippoli GF, Tong A, Johnson D, Schena FP, Craig JC. Catheter-related interventions to prevent peritonitis in peritoneal dialysis: a systematic review of randomized, controlled trials. J Am Soc Nephrol 2004; 15: 2735-46.
10. Valdivia-Gomez GG, Jaramillo-de la Torre E. Paramedian or midline approach in the insertion of a Tenckhoff catheter in patients with ambulatory continuous peritoneal dialysis. Comparative study. Cir Cir 2004; 72: 193-201.
11. Liu WJ, Hooi LS. Complications after tenckhoff catheter insertion: a single-centre experience using multiple operators over four years. Perit Dial Int 2010; 30: 509-12.
12. Messana JM, Block GA, Swartz RD. Injury to the inferior epigastric artery complicating percutaneous peritoneal dialysis catheter insertion. Perit Dial Int 2001; 21: 313-5.

ผลทางคลินิกในการวางสายแคทธีเตอร์โดยวิธี พารามีเดียน เทียบกับ มิดไลน์ ในผู้ป่วยที่ได้รับการบำบัดทดแทนไตทางช่องท้อง

ชวศักดิ์ กนกกันฑพงษ์, ณภัทร หลีอาภรณ์, เถลิงศักดิ์ กาญจนบุษย์

วัตถุประสงค์*: เพื่อศึกษาเปรียบเทียบอัตราการเกิดภาวะแทรกซ้อนระยะแรกและความสำเร็จทางคลินิกระยะยาวในผู้ป่วยที่ได้รับการบำบัดทดแทนไตทางช่องท้องที่ได้รับการผ่าตัดวางสายชนิดข้างเตียง ระหว่างเทคนิคการวางสายผ่านมิดไลน์ และ พารามีเดียน*

วัสดุและวิธีการ*: เป็นการศึกษาย้อนหลัง เก็บข้อมูลผู้ป่วยที่ได้รับการบำบัดทดแทนไตทางช่องท้องทุกรายที่รับการรักษาที่โรงพยาบาลมหาราชนครราชสีมา ในช่วง พ.ศ. 2551-2553 โดยเก็บข้อมูลพื้นฐานของผู้ป่วย เพศ อายุ โรคร่วม ผลการตรวจทางห้องปฏิบัติการก่อนเริ่มการล้างไตทางช่องท้อง ภาวะแทรกซ้อนระยะแรกหลังผ่าตัดวางสาย และผลลัพธ์การรักษาระยะยาว*

ผลการศึกษา*: มีผู้ป่วยที่ได้รับการผ่าตัดวางสาย ณ โรงพยาบาลมหาราชนครราชสีมา จำนวน 392 ราย พบเวชระเบียนไม่สมบูรณ์จำเป็นต้องคัดออก 43 ราย เหลือผู้ป่วยที่ใช้สำหรับทำการศึกษาทั้งสิ้น 349 ราย แบ่งเป็นกลุ่มพารามีเดียน 90 ราย และกลุ่มมิดไลน์ 259 ราย มีอายุเฉลี่ย 51.7 ปี เป็นเพศชายร้อยละ 52 น้ำหนักเฉลี่ย 57.5 กิโลกรัม สูงเฉลี่ย 159.9 เซนติเมตร ดัชนีมวลกาย 22.5 เป็นเบาหวานร้อยละ 28.9 ความดันโลหิตสูงร้อยละ 58.5 เป็นเบาหวานร่วมกับความดันโลหิตสูงร้อยละ 27.5 ส่วนใหญ่ของผู้ป่วยมีการศึกษาระดับประถมร้อยละ 57.0 ผู้ป่วยส่วนใหญ่ไม่สามารถทำการบำบัดทดแทนไตทางช่องท้องเองได้ต้องมีญาติช่วยร้อยละ 67.7 พบว่ากลุ่มพารามีเดียน มีภาวะแทรกซ้อนหลังวางสายร้อยละ 17.8 และกลุ่มมิดไลน์ ร้อยละ 18.9, p = 0.02 โดยผู้ป่วยในกลุ่มพารามีเดียน มีผลลัพธ์ระยะยาวดีกว่ากลุ่มมิดไลน์ ทั้งในด้านอายุการใช้งานสายแคทธีเตอร์ (ค่าเฉลี่ย 948.5 วัน และ 698.1 วัน, p = 0.048); อัตรารอดของผู้ป่วย (ค่าเฉลี่ย 915.4 วัน และ 700.6 วัน, p = 0.01) แต่ไม่พบความแตกต่างในอัตราการติดเชื้อในช่องท้อง (ค่าเฉลี่ย 848.7 วัน และ 824.3 วัน, p = 0.93)*

สรุป*: การวางสายแคทธีเตอร์ที่ตำแหน่งพารามีเดียน มีภาวะแทรกซ้อนระยะแรกหลังวางต่ำกว่า มีอายุการใช้งานของสายและอัตรารอดชีวิตของผู้ป่วยดีกว่าการวางสายที่ตำแหน่งมิดไลน์ ด้วยเหตุนี้แพทย์ควรพิจารณาวางสายแคทธีเตอร์ในตำแหน่งพารามีเดียนแก่ผู้ทุกราย*