ผลของโปรแกรมการฝึกอบรมโดยทีมสหสาขาวิชาชีพต่อความรู้และการปฏิบัติตัวของผู้ป่วยหรือผู้ดูแลในการป้องกันการติดเชื้อและปัญหาจากการใช้ยาในผู้ป่วยล้างไตทางช่องท้อง โรงพยาบาลชัยนาทนเรนทร

Effects of Training Program by Multidisciplinary Team on Knowledge and Practice of Patients or Caregivers for Infection Prevention and Drug Therapy Problems in Peritoneal Dialysis Patients in Jainad Narendra Hospital

นิพนธ์ต้นฉบับ **Original Article**

นงลักษณ์ ขันอ่อน[1], ชุลีกร สอนสุวิทย์[2] และ เพ็ญกาญจน์ กาญจนรัตน์[2]*

[1] ฝ่ายเภสัชกรรม โรงพยาบาลชัยนาทนเรนทร อ.เมือง จ.ชัยนาท 17000
[2] คณะเภสัชศาสตร์ มหาวิทยาลัยเชียงใหม่ อ.เมืองเชียงใหม่ จ.เชียงใหม่ 50200
*** Corresponding author:** penkarn.k@cmu.ac.th

วารสารไทยเภสัชศาสตร์และวิทยาการสุขภาพ2564;16(3):169-178.

Nongluck Khanon[1], Chuleegone Sornsuvit[2] and Penkarn Karnganarat[2]*

[1] Pharmacy Department, Jainad Narendra Hospital, Munag, Jainad, 17000, Thailand
[2] Faculty of Pharmacy, Chiangmai University, Muang, Chiangmai, 50200, Thailand
*** Corresponding author:** penkarn.k@cmu.ac.th

Thai Pharmaceutical and Health Science Journal 2021;16(3):169-178.

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาผลของโปรแกรมการฝึกอบรมโดยทีมสหสาขาวิชาชีพต่อความรู้และการปฏิบัติตัวของผู้ป่วยหรือผู้ดูแลในการป้องกันการติดเชื้อในผู้ป่วยล้างไตทางช่องท้อง (continuous ambulatory peritoneal dialysis; CAPD) อุบัติการณ์การติดเชื้อที่สัมพันธ์กับการล้างไตทางช่องท้อง และปัญหาที่เกิดจากการใช้ยา **วิธีการศึกษา:** การวิจัยกึ่งทดลองแบบสองกลุ่มวัดผลก่อนและหลังการทดลอง กลุ่มตัวอย่างที่ศึกษาคือ ผู้ป่วย CAPD หรือผู้ดูแลที่มารับบริการ ณ โรงพยาบาลชัยนาทนเรนทร จำนวน 64 คน แบ่งกลุ่มทดลองและกลุ่มควบคุมตามการนัดสัปดาห์คู่คี่กลุ่มละ 32 คน กลุ่มทดลองได้รับโปรแกรมการฝึกอบรมโดยทีมสหสาขาวิชาชีพ กลุ่มควบคุมได้รับการดูแลตามปกติ ระยะเวลา 12 สัปดาห์ เก็บข้อมูลส่วนบุคคล ความรู้ในการดูแลตนเอง การปฏิบัติตัวตามขั้นตอนการล้างไตทางช่องท้อง และปัญหาที่เกิดจากการใช้ยา วิเคราะห์ข้อมูลด้วยสถิติเชิงพรรณนา สถิติไคสแควร์ สถิติทีคู่และทีอิสระ สถิติฟิชเชอร์ **ผลการศึกษา:** ค่าเฉลี่ยคะแนนความรู้การดูแลตนเองในกลุ่มทดลองสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญ (26.8 และ 22.1, *P*-value < 0.001) ค่าเฉลี่ยคะแนนการปฏิบัติตัวหลังได้รับโปรแกรมสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญ (160.1 และ 136.5 คะแนน, *P*-value < 0.001) จำนวนปัญหาจากการใช้ยาหลังได้รับโปรแกรมกลุ่มทดลองต่ำกว่ากลุ่มควบคุม (1.1 และ1.6 ปัญหา) อุบัติการณ์การติดเชื้อกลุ่มทดลองน้อยกว่ากลุ่มควบคุมแต่ไม่มีนัยสำคัญทางสถิติ (0.0003 และ 0.001 ครั้งต่อผู้ป่วย-วัน, *P*-value = 0.33) **สรุป:** โปรแกรมการการฝึกอบรมโดยทีมสหสาขาวิชาชีพสามารถเพิ่มความรู้และการปฏิบัติตัวในการดูแลตนเองในผู้ป่วย CAPD เมื่อเทียบกับการรักษาตามปกติ อย่างไรก็ตามอุบัติการณ์การติดเชื้อใน 3 เดือนของกลุ่มที่ได้รับการฝึกอบรมไม่ต่างกับการรักษาตามปกติ

คำสำคัญ: โปรแกรมการฝึกอบรม, ทีมสหสาขาวิชาชีพ, การติดเชื้อในผู้ป่วยล้างไตทางช่องท้อง, ผู้ป่วยล้างไตทางช่องท้องแบบต่อเนื่อง, ปัญหาที่เกิดจากการใช้ยา

Editorial note
Manuscript received in original form: June 3, 2020;
Revised: August 16, 2020;
Accepted in final form: August 19, 2020;
Published online: September 26, 2021.

Abstract

Objective: To study effects of the Training Program by Multidisciplinary Team for Infection Prevention of CAPD (TPMTIP) on knowledge and practice of patients or caregivers for infection prevention in continuous ambulatory peritoneal dialysis (CAPD) patients, incidence of CAPD related infections and drug therapy problems (DRPs). **Method:** In this quasi-experimental research with two group pretest-posttest design, 64 CAPD patients were assigned to either control group or TPMTIP (test) group (n = 32 each) if they received care in odds or even week, respectively. The test group received training program by multidisciplinary team on knowledge and practice of patients or caregivers, while the control group received usual care, each for 12 weeks. We collected data of personal characteristics, self-care knowledge, self-assessment of CAPD practice, and DRPs at pre-and post-test. Data were analyzed using descriptive statistics, chi-square test, paired t test, independent t test, and Fisher's exact test. **Results**: At wee k12, both mean scores of self-care knowledge and CAPD actual practice in the test group were significantly higher than the control group (26.8 and 22.1 points, respectively, *P*-value < 0.001; 160.1 and 136.5 points, respectively, *P*-value < 0.001). Number of DRPs in the test group was lower than the control group (1.1 and 1.6 problems, respectively). Incidence of CAPD related infections was lower in the test group but with no statistical significance (0.0003 and 0.001 episode per patient-days, *P*-value = 0.33). **Conclusion**: TPMTIP could increase self-care knowledge and practice to prevent CAPD related infctions. However, the incidence of infections with TPMIP was not different from that with the usual care.

Keywords: training program, multidisciplinary team, infection in peritoneal dialysis patients, continuous ambulatory peritoneal dialysis, drug therapy problems

Journal website: http://ejournals.swu.ac.th/index.php/pharm/index

Introduction

Patients with peritoneal dialysis has been facing dialysis related infections and drug related problems. Various interventions have been tested to prevent such infections and drug related problems. Effectiveness of those interventions has been limited, therefore there is a need for a more effective intervention. We studied the effects of the Training Program by Multidisciplinary Team for Infection Prevention of CAPD (TPMTIP).

A number of patients with ESRD undergoing continuous ambulatory peritoneal dialysis (CAPD) have been increasing

worldwide.[1] In 2018, of all patients receiving renal replacement therapy, 369,000 cases (9.0%) undergoing CAPD; while 2,993,000 (72.0%) on hemodialysis and 786,000 cases (19.0%) given renal transplant.[2] There has been an increase in number of CAPD patients with more availability of advanced innovation and technique for ESRD patients. With more advanced technology, survival rate of CAPD has been increasing up to that of hemodialysis. Based on the change in public health policy, CAPD has been increasingly promoted for renal replacement therapy worldwide to handle the problems of limited expenditure, personnel, and centers for hemodialysis.[3]

In Thailand, CAPD has been the renal replacement therapy with the fifth among countries worldwide in number of patients.[4] Based on the PD First Policy of the National Health Security Office (NHSO), all Thai patients have been encouraged to receive CAPD as the first choice of renal replacement therapy since October 30, 2007. This allows all patients under the universal coverage payment scheme of the NHSO which serves the majority of Thai people to have an easier access to CAPD service. The prevalence of 5,133 patients on CAPD in 2009 increased to 24,244 patients in 2015.[5] Aside from the increasing number of patients served, certain problems and complications emerged because of the complicate process of CAPD such as changing the dialysis solution 4 – 6 times daily and other strict self-care.

Frequently found complications of CAPD include PD related peritonitis, catheter related peritonitis, cardiovascular complications, electrolyte imbalance. As the most frequent complication, worldwide prevalence rate of CAPD related peritonitis has been 0.24 – 1.66 cases per year including PD related peritonitis of 3.0 – 20.0% (a mean of 14.0%) and catheter related peritonitis of 10.0 – 88.0% (a mean of 22.0%0, switching to hemodialysis of 9.0 – 74.0% (a mean of 18.0%), and death of 0.9 – 8.6% (a mean of 2.0 – 6.0%).[3] CAPD related infections are peritonitis, exit-site infection (ESI) and tunnel infection. Hospitalization, as a consequence of these infections, poses burdens and sufferings on the patient and their family both physical and psychologically, which could be devastating and life-threatening. Economically, the burden on expenditure on family and society levels usually forces the patient to discontinue CAPD and/or to switch to hemodialysis.

Problems in CAPD could be related to various causes especially the patient poor self-care. For peritonitis, poor or incorrect self-care, insufficient hygiene on skin and device cleaning, non-compliance to advice of physicians and nurses, and environment unsuitable for CAPD operation.[6,7 In] In 2017, among 90 patients receiving CAPD provided by Jainad Narendra Hospital, an incidence of 78 CAPD related infections, i.e., 0.87 incidents per patient per year, was found. Of the 78 infections, there 43, 34 and 1 or 55.1%, 43.6% and 1.3% of peritonitis, exit-site infection and tunnel infection, respectively. Based on the 2016 criterion of 0.5 peritonitis incidents per year of the International Society for Peritoneal Dialysis (ISPD)[8], performance of CAPD care provided by Jainad Narendra Hospital was unsuccessful.

The first three most influencing factors for peritonitis among patients with CAPD include inappropriate cleaning on body surface and devices, noncompliance with standard protocol (including skipping or ignoring certain steps), and environment unsuitable for CAPD. The cause of such behavioral factors influencing infections in patients with CAPD was a lack of knowledge about proper self-care and hygiene protocol. In addition, poor nutritional status makes the patients more susceptible to infection. It has been known that patients with malnutrition and hypoalbuminemia have a higher risk of infection while on CAPD.[9]

In our pilot study at Jainad Narendra Hospital, we investigated self-care and drug use among 20 patients receiving CAPD. Our interview revealed that 54.4% of the patients possessed knowledge about medications. Unfortunately almost half of them lacked necessary medication knowledge such as how to keep erythropoietin for red blood cell production stimulation and its allergy. In addition to a lack of knowledge about medications, patients with CAPD usually take a large number of medications for a life-time treatment course for their end-stage renal disease and its co-morbidity and complications such as diabetes, hypertension, hyperlipidemia, hyperphosphatemia, acidosis, water retention, and anemia. A large number of medications lead to various drug related problems including wrong drugs, wrong doses, wrong administration time, self-discontinuation, lack of knowledge about drug names, indications and proper storage, missing taking drugs, or experiencing drug interactions which could result in poor therapeutic outcomes.

There is a need to improve knowledge and understanding and promote self-care in patients receiving CAPD, as well as reduce CAPD related infections. Our study was based on the self-management concept of Curtin and colleagues[10], concept of shared care of Sebern[11], interdisciplinary teamwork

concept[12] and pharmaceutical care concept.[13] We applied communication, decision making, participation in self-care, and compliance to therapeutic plan into our training program by multidisciplinary team to improve knowledge and self-care practice in patients and/or caregivers. This program was called the Training Program by Multidisciplinary Team for Infection Prevention of CAPD (TPMTIP). With its complicate, unique setting and procedure, self-care among patients with CAPD is complicate and specific. It is different from self-care in patients with other chronic illness or even patients with hemodialysis. The patients and their caregivers need to understand various self-care practices such as diet control, water restriction, medication compliance and storage, exit-site hygiene, PD solution change, observation on complications, and activities of daily living. Proper self-care knowledge and practice could allow the patients and their caregivers take a good care of the patient.

In this study we aimed to determine the effects of TPMTIP on knowledge and practice of self-care among the patients or caregivers in preventing CAPD related infection and on the incidence of CAPD related infection compared with those receiving the usual care. We also aimed to determine types and number of drug related problems (DRPs) between the patients receiving TPMTIP and those receiving the usual care. Specifically, we hypothesized that at the end of the study, scores of knowledge and self-care practice of the patients receiving CAPD were higher than those receiving the usual care. Within each group, scores of knowledge and self-care practice at the end of the study were higher than those at baseline (i.e., before the intervention). At the end of the study, incidence rate of CAPD related infection in the TPMTIP group was lower than that of the usual care group. For DRPs, patients in TPMTIP group had fewer DRPs than those receiving the usual care.

Methods

In this quasi-experimental research, we used a pretest-posttest design with control group). Study sample was patients undergoing CAPD at the CAPD unit of Jainad Narendra Hospital, Jainad province, during a 12-week period from April to July 2019. To be eligible, the patients had to be 15 years old or older and have CAPD of at least 3 months which is the critical period of high risk of CAPD infection since the patients are mostly getting familiar with the hygiene and self-care to prevent the infection. They had to be able to communicate with Thai language, have caregiver to participate for the patient who did not perform CAPD by him- or herself, have the same caregiver throughout the study period, and be willing to participate in the study. We excluded patients who had peritonitis, exit-site infection or tunnel infection during the study period, been treated with antibiotics at the screening or the start of the study, or severe complications during the training period.

Participants were selected to receive either TPMTIP (test group) or usual care (control group) by simple random sampling of the week of the month of CAPD clinic at Jainad Narendra Hospital. Even week was assigned to the test group while the odd week to the control group. Individual patients were selected by match-paired sampling based on gender, age of less than 5 years difference, and difference in duration of CAPD modality of less than 6 months which could determine capability to self-care.[14] Sample size was estimated based on knowledge scores of 15.54 ± 3.06 and 17.81 ± 1.61 points in the intervention group and control group, respectively.[15] With a type I error or 5% and a power of test of 80%, 29 participants per group were required. To compensate for an attrition rate of 10%, 32 participants per group were needed. The calculation was conducted using a software available on the website https://clincalc.com/stats/samplesize.aspx.

Interventions

The test group

The intervention tools were the TPMTIP and the usual care for patients receiving CAPD. Based on the concepts of self-management[10], shared care[11], interdisciplinary teamwork[12] and pharmaceutical care[13], four kinds of activities included 1) provision of four aspects of knowledge, 2) learning materials as reminder (posters), 3) phone call to follow up and remind of infection prevention, and 4) home visit for CAPD monitoring. These activities were held within the 12 weeks of the study as follows.

In week 1 and 2, multidisciplinary team provided knowledge of steps of CAPD, medications, diet control and self-care, and observation for any abnormalities or complications that prompt medical attention. Three aspects of the shared care concept, namely communication, decision-making and reciprocity helped handle the complexity and difficulties of CAPD care. Patients and their caregivers had to

learn such complexity to be able to adapt to the complicate situation and manage the problems together effectively. Problem sharing and decision making in the self-care process could benefit the patient which could be done through effective communication among patients, caregivers and healthcare providers. Effective communication could help transfer information for shared understanding and proper self-care practice. Good relationship between patients, caregivers and healthcare providers could further improve treatment outcomes.

In weeks 3 and 9, phone calls to the patient were made to examine the CAPD steps the patient has to follow and understanding about self-care. The calls were also to identify problems, if any, by allowing the patient and caregiver to communicate and share their problems with multidisciplinary team for mutual understanding which could be used in recommending proper self-care practice.

In weeks 3 and 11, the patient performed two self-assessments, one for each week, on CAPD steps. Based on the self-care concept, self-care activities and treatment adherence were self-examined by the patient using a checklist created by the researcher. The self-care activities were meant to help prevent infections.

In weeks 4 and 8, knowledge was provided two times, one for each week, for each individual patient. Based on concepts of multidisciplinary work and pharmaceutical care, the knowledge was provided and with the individual consultation session, the patient could feel comfortable to share their problems. Solutions suitable for individual patients could be made. The issues included selecting foods appropriate for their diseases, and solving their drug related problems.

In weeks 6 and 7, home visits for CAPD were carried out by multidisciplinary team to evaluate environment and actual practice of the patient. Information from the evaluation was incorporated in self-care promotion using the concept of partnership in care. The patient and caregiver were trained on CAPD protocol and self-care by multidisciplinary team.

In week 12, knowledge and practice of the patient was assessed. Drug related problems and CAPD related infection were also evaluated. The results of evaluation were informed to the individual patient.

The control group

Participants in the control group were provided with the usual care. Nurses at the CAPD unit advised the participants and their caregivers about CAPD protocol, diet control, exit-site hygiene, and observation and management of abnormalities and complications.

Data collection instruments

Data collection form consisted of 4 parts. The first part collected demographic characteristics of the patients including gender, age, marital status, insurance payment scheme, education level, occupation, family member status, and main caregiver. Health status information was also collected, including co-morbid illnesses, and duration of CAPD.

The second part was a questionnaire evaluating knowledge about self-care of patients with CAPD developed by the researcher based on previous research.[16] The questionnaire consisted of 28 questions asking 4 dimensions of self-care including CAPD steps (12 questions), medications (6 questions), diet and self-care (6 questions), and vigilance of signs and symptoms of complications to seek medical attention (4 questions). With the possible answer of yes, no and not know, a score of 1 point was rewarded for a correct answer, and 0 points for a wrong or “not know” answer. With the possible total score of 0 – 28 points, the actual total score of each patient was calculated as percentage and categorized as low, moderate and high level of self-care knowledge (< 60%, 60 – 79%, and 80 – 100%, respectively).

The third part was a checklist of actual practice of 6 CAPD steps to prevent infection. The patient or caregiver was supposed to inspect what they did and record it in this checklist 4 times a day with each CAPD run, 7 days a week, for 2 rounds of the 7-day inspection. The first 7-day inspection round was after group knowledge provision (week 3) and the second round was after individual patient knowledge provision (week 11). One point was given a step performed, and zero point otherwise. With 6 steps of actual practice to be asked, 4 times per day and 7 days per week (or 1 round), a total score of 0 – 168 points for each round could be achieved. The actual score each individual patient achieved was calculated as percentage.

The fourth part was for collecting drug related problems specifically on medication compliance. Five aspects of medication non-compliance included 1) taking dose higher or lower than prescribed, 2) taking medication in a day more frequently than prescribed, 3) forgetting to take medication, 4) not taking prescribed medications, and 5) using mediations with wrong technique or wrong route. These non-compliance

was modified from the work of Sthapornnanon.[17] Pharmacist evaluated drug related problems before and after TPMTIP program (i.e., weeks 0 and 12).

Research instrument quality assurance

Content validity of questions about knowledge about self-care of patients with CAPD (part 2) and actual practice of CAPD steps to prevent infection (part 3) were examined by nine experts working at Jainad Narendra Hospital. The questions were revised according to suggestions. To test for internal consistency reliability, the questionnaire was tested with 20 patients comparable to the actual participants. Internal consistency reliability of questions about self-care of patients with CAPD was high with a Cronbach's alpha coefficient of 0.935.

Human protection

The study was approved by the Ethics Committee for Human Study of Jainad Narendra Hospital (Approval number: 02/2562, approval date: April 1, 2019).

Data collection procedure

The researcher (N. Khanon) introduced herself to prospective participants to ask for participation. Study objective, process and voluntary nature was provided. With human protection, participants could withdraw from the study at any time. Once agreed to participate, written informed consent was obtained. At week 0, data of demographic characteristics and health status were collected. Knowledge about self-care of patients with CAPD was evaluated by interview by the researcher at weeks 0 and 12. If CAPD was given by caregivers, they were interviewed. The scores of actual practice of CAPD steps were collected from the patient's self-record at weeks 3 and 11. For drug related problems, patients and caregivers were interviewed by the researcher at weeks 0 and 12. Drug related problems were identified and remaining medications were counted. For CAPD related infections, incidences of related infections were identified from physician's diagnosis in medical records and nurse's CAPD related infection report at week 12. These infections included peritonitis, exit-site infection (ESI) and tunnel infection. The data included number and percent of patients with infection, follow-up duration until infection (person-days), follow-up duration (person-days), incident rate ratio (person-days), infection rate (times/patient-years).

Statistical data analysis

Demographic and health status characteristics were presented as descriptive statistics including frequency with percentage and mean with standard deviation (SD). Differences of categorical variables between the two groups were tested using chi-square test or Fisher's exact test, as appropriate. Continuous variables were compared using independent t test or Mann-Whitney U test, if not normally distributed. Scores of knowledge and actual practice between the two groups were compared using independent t test or Mann-Whitney U test, if not normally distributed. Incidence rate of CAPD related infection between the two groups was tested with Fisher's exact test as incidence rate ratio with 95% confidence interval (CI). Significance level was set at a type I error of 5% or P-value < 0.05. All statistical analyses were performed using software program STATA version 14.0.

Results

Of the 64 participants, 32 to receive TPMTIP program (test group) and another 32 to the usual care (control group). The participants were 58.9 years old by average (Table 1). The majority of the participants in the test and control grops were female (65.6% for both), had spouse as main caregiver (62.5% and 46.9%, respectively), had CAPD duration of 1 – 2 years (40.6% for both), were married (78.1% and 93.7%, respectively), had primary education (78.1% and 71.9%, respectively), had no job (59.4% for both), had family monthly income of 500 – 5,000 Baht (37.5% and 43.7%, respectively). CAPD was performed by themselves in 21.9% in the test group and 31.2% in the control group. All participants had hypertension, followed by diabetes (31.2% and 28.1% in the test and control groups, respectively). Differences in all characteristics were not statistically significant.

Knowledge about self-care for CAPD patients

Mean scores of knowledge of self-care for CAPD patients before the program were not different between the two groups (Table 2). However, after the program, mean score in the test group (26.8 points) was significantly higher than that of the control group (22.2 points) (*P*-value < 0.001). After the program, knowledge of knowledge of self-care for CAPD patients in the test group was at high level while that in the control group was at moderate level (Table 3). In addition, all four aspects of knowledge in the test group were at high level;

while in the control group, only two were at high level, and one each at moderate and low level.

Actual practice on CAPD steps to prevent infection

The first evaluation of actual practice at week 3 revealed that mean score in control group (146 points) was slightly higher than that of the test group (138.2 points) with no statistical significance (*P*-value = 0.315). At the second evaluation at week 11, mean score of the test group was significantly higher than that in the control group (160.1 and 136.5 points, respectively, *P*-value < 0.001).

Table 1 Demographic and health status characteristics of participants (N = 64).

Characteristics	N (%)		*P*-value
	Test group (n = 32)	Control group (n = 32)	
Gender			
Male	11 (34.4)	11 (34.3)	1.000[a]
Female	21 (65.6)	21 (65.6)	
Age (years)			
40 - 49	4 (12.5)	4 (12.5)	1.000[b]
50 - 59	10 (31.2)	10 (31.2)	
60 - 69	15 (46.8)	15 (46.9)	
70 or older	3 (9.3)	3 (9.4)	
Mean = 58.95 ± 9.75, Min = 34, Max = 77			
Marital status			
Single	6 (18.7)	1 (3.1)	0.113[a]
Married	25 (78.1)	30 (93.7)	
Widowed	1 (3.1)	-	
Divorced/separated	-	1 (3.1)	
Education level			
No formal education	-	-	0.574[a]
Primary school	25 (78.1)	23 (71.9)	
Secondary school	5 (15.6)	8 (25.0)	
Bachelor's degree or higher	2 (6.2)	1 (3.1)	
Occupation			
No job	19 (59.4)	19 (59.4)	1.000[a]
Agriculture	8 (25.0)	8 (25.0)	
Labor	-	-	
Government employee	1 (3.1)	1 (3.1)	
Small business	4 (12.5)	4 (12.5)	
Monthly family income (Baht)			
500 - 5,000	12 (37.5)	14 (43.7)	0.551[a]
5,001 – 10,000	10 (31.2)	8 (25.0)	
10,001 – 20,000	7 (21.9)	9 (28.1)	
20,001 or higher	3 (9.4)	1 (3.1)	
Main caregiver			
Spouse	20 (62.5)	15 (46.9)	0.452[a]
Offsprings	5 (15.6)	7 (21.9)	
Self-care	7 (21.9)	10 (31.2)	
Co-morbidity			
Hypertension	11 (34.4)	13 (40.6)	0.881[a]
Hypertension and diabetes	10 (31.2)	9 (28.1)	
Hypertension, diabetes, and heart disease	2 (6.2)	3 (9.4)	
Hypertension and hyperlipidemia	9 (28.1)	7 (21.9)	
Duration of CAPD (years)			
< 1	12 (37.5)	12 (37.5)	1.000[a]
1 – 2	13 (40.6)	13 (40.6)	
> 2	7 (21.9)	7 (21.9)	

[a] Chi-square test.

[b] Independent t test.

Table 2 Mean scores of knowledge of self-care for CAPD patients (N = 64).

	Mean score (SD)* by groups		*P*-value[a]
	Test group	Control group	
Before experiment	21.8 (2.1)	21.9 (1.4)	0.216
After experiment	26.8 (1.5)	22.2 (2.6)	< 0.001

[a] Independent t-test.

* The total score of 28 points.

Table 3 Mean scores and level of all knowledge aspects of self-care for CAPD patients after the program (N = 64).

Knowledge aspects	Scores after the program					
	Test group			Control group		
	Mean	SD	Level	Mean	SD	Level
Overall knowledge*	26.8	1.5	High	22.2	2.6	Moderate
Aspects of knowledge†						
Knowledge about CAPD steps	11.7	0.6	High	10.8	0.8	High
Knowledge about medications	5.5	0.8	High	3.5	1.1	Low
Knowledge about diet control and self-care	5.6	0.6	High	4.0	1.1	Moderate
Knowledge about signs and symptoms prompting medical attention	4.0	0	High	3.9	0.2	High

* The total score of 28 points.

† The total score of each aspect: 12, 6, 6, and 4 for aspects of CAPD steps, medications, diet control and self-care, and signs and symptoms prompting medical attention.

Table 4 Mean scores of actual practice of CAPD patients to prevent infection* (N = 64).

Evaluation point	Scores, mean (SD)		*P*-value[a]
	Test group (n = 32)	Control group (n = 32)	
First (week 3)	138.2 (38.3)	146.2 (20.8)	0.315
Second (week 11)	160.1 (21.6)	136.5 (28.2)	< 0.001

[a] Independent t-test.

* Possible total score of 0 – 168 points.

Drug related problems

Among patients participating the TPMTIP, they experienced 1.7 DRPs per patient at the start of the study (Table 5). At the end of the study (week 12), number of DRPs decreased to 1.1 DRPs per patient. While the number of DRPs per patient (1.1) among patients in the test group was low at the end of the study, the number in the control test was higher (1.6 DRPs per patient).

The most found DRPs were medication non-compliance of which 23 non-compliance DRPs (65.7% of all DRPs) were found in the test group while 50 in the control group DRPs (66.7% of all DRPs) (Table 6). These non-compliance DRPs included administration with wrong technique or route (eg., patients forgetting to chew calcium carbonate tablets before swallowing, and wrong insulin injection both wrong injection sites and wrong technique). At the end of the study, patients in the test group had a low number of non-compliance (wrong technique or route) experienced only 6 non-compliance DRPs

(26.1%) while those in the control group experienced 28 events (56.0%).

Table 5 Mean number of drug related problems per patient (N = 64).

Evaluation point	Scores, mean (SD)	
	Test group (n = 32)	Control group (n = 32)
Before the intervention (week 0)	1.7 (0.9)	-
After the intervention (week 12)	1.1 (0.9)	1.6 (0.9)

Table 6 Drug related problems and relating causes (N = 64).

Drug related problems and causes	N (%)	
	Test group (n = 32)	Control group (n = 32)
1. Taking medication with doses lower or higher than prescribed	5 (21.7)	9 (18.0)
Not reading the medication labels when dose was adjusted by the physician	3	4
Avoiding taking medications because of stomach bloating and flatulence caused by water accompanying the medications and water restriction	0	2
Self-lowering dose because of boredom and despair in the treatment	2	3
2. Number of medication administration per day was different from what was prescribed	4 (17.4)	7 (14.0)
Not reading the medication labels when dose was adjusted by the physician	4	4
Lacking knowledge about disease and medications, eg., not taking medications because not having lunch	0	3
3. Forgetting to take medications	3 (13.0)	2 (4.0)
Getting caught in work, business or errands		
4. Not taking medications as prescribed	5 (21.7)	4 (8.0)
Having serious drug side effects or allergy	2	2
Discontinuing medications because of illnesses, eg., cold or diarrhea	1	1
Running out of medication supply before the scheduled visit because of inadequate supply or missing the scheduled visit	2	1
5. Wrong technique or route of drug administration	6 (26.1)	28 (56.0)
Not chewing calcium carbonate tablets before swallowing	4	20
Wrong insulin injection site and technique	2	8

Incidence of CAPD related infections

Incidence of CAPD infections in the test group (1 patient, or 3.1%) was lower than that in the control group (3 patients, or 9.4%) with no statistical significance (*P*-value = 0.615) (Table 7). Once person-years of follow-up of all patients were considered, rate of CAPD related infection in the test group was 0.33 times of that of the control group with no statistical significance (rete ratio of 0.33, 95% CI = 0.37 – 3.04, *P*-value = 0.33). Consistent with incidence rate, infection rates were 0.14 and 0.42 cases/person-years in the test and control groups, respectively.

Table 7 Incidence of CAPD related infections (N = 64).

Incidence of infection	Test group (n = 32)	Control group (n = 32)	Rate ratio (95% CI)	*P*-value
Number of infected cases, n (%)	1 (3.1)	3 (9.4)		0.615[a]
Follow-up duration (person-days)	2630	2608		
Incident rate of infection (cases/person-days)	0.0003	0.001	0.33 (0.37 - 3.04)	0.33[a]
Infection rate (cases/person-years)*	0.14	0.42		0.33[a]

[a] Fisher's exact test.

* In the test group, 1/(2630/365) = 0.14; in the control group 3/(2608/365) = 0.42

Discussions and Conclusion

In this study we examined the effects of TPMTIP on knowledge and practice of self-care among the patients or caregivers in preventing CAPD related infection and on the incidence of CAPD related infection compared with those receiving the usual care.

Knowledge about CAPD self-care and hygiene to prevent CAPD infection was significantly higher in patients receiving TPMTIP than those receiving the usual care. The most improved aspect of knowledge in patients receiving TPMTIP was wearing mask before washing hands, from 53.1% to 84.4% (data not shown in Results). This improvement could be due to a clear visual learning from the poster showing 5 steps to prevent CAPD related infection. This poster was given to the patient as a home-base reminder. Patients reported the poster helped reduce errors and remind them the essential steps of CAPD. With its large size, clear font, eye-catching design and clear message, the patients and caregivers could understand and memorize steps precisely. A study also suggested that poster promotes infection preventive behavior amond healthcare personnel.[17]

For knowledge about medications, diet and signs and symptoms to prompy medical attention, TPMTIP individual patient knowledge provision could solve specific problems and encourage the patients to use their existing knowledge. As a result, the patients were more engaged and more willing to share their problems than those seeing the physician for their usual care. The multidisciplinary team examined how the patient performed CAPD, self-care, medication use, diet, and monitoring signs and symptoms requiring medical attention so the causes of any problems could be identified and the problems could be solved. Our findings were consistent with previous studies where multidisciplinary teacm could improved scores of knowledge and self-care significantly.[18,19]

The actual practice to prevent CAPD related infection was significantly in TPMTIP group than the usual care group at the second assessment (i.e., week 11). This improved actual practice score could be attributable to various services through telephone call to follow-up and remind infection prevention, checklist for self-examiniation on essential CAPD steps, and home visit to remind CAPD steps and self-care. We found that all patients co-operated well with the multidisciplinary team and complied with scheduled activities. A previous study revealed that home visit and telephone call improved health behavior practice score significantly, both overall and individual behavior practices, among hypertensive patients (*P*-value < 0.05).[20] This suggests that telephone call, as a two-way communication tool, is an effective, convenient, fast, and cheap to promote knowledge and self-care practice.

TPMTIP also resulted in less drug related problems than the usual care. Multidisciplinary team provided knowledge and training to patients and caregivers with group and individual patient education sessions. In the TPMTIP group, the pharmacist focused on identifying and solving drug related problems; while in the usual care, physicians and nurses took care of drug related problems. We found that most drug related problems were medication non-compliance which could impair therapeutic outcomes. This non-compliance could cause blood and electrolyte imbalance which could further cause CAPD related infections.[21] A previous study showed that pharmacists could reduce drug related problems of which pharmaceutical care provided by the pharmacist significantly improved knowledge about disease and medications, self-care behavior, and medication compliance, and reduced drug related problems (*P*-value < 0.05).[22] Another study showed that pharmacist's counseling on drug use improved medication compliance significantly (*P*-value < 0.05).[23] These consistent findings were evident, however, certain problms remained, for example, boredom and despair from chronic illness with no cure despite a large number of medications taken discouraged the patient from complying with prescribed medication regimen. Therefore we proposed that there should be psychiatrist or psychologist to help rehabilitate the patient's mental health.

Incidence of CAPD related infection in our study was low in both groups with 0.0003 and 0.001 cases/person-days (or 0.14 and 0.42 cases/person-years) in test and control groups, respectively, with no statistical significance (*P*-value = 0.33). This infection rate was lower than 0.87 cases/person-years found in 2017 and lower than the criterion of which was 0.5 cases/year.

Our incidence of CAPD related infection in our study was higher than in the previous study of Gadola and colleagues reporting that the peritoneal dialysis education program which was a multidisciplinary team training for individual patients to prevent peritonitis.[24] They found that peritonitis rate of 0.24 infections per patient-years at the beginning was reduced to 0.09 infections per patient-years at the end of the study with statistical significance (*P*-value < 0.05).[24] A study in Thailand examined the benefit of an empowerment program to promote prevention of CAPD related infections and found that patients participating the program had no infections while two of those receiving the usual care had infections.[25] Our finding of high incidence of infection could be due to a short study duration of 3 months while other studius had 28 and 4 months.[24,25] In addition the two previous studies used empowerment and motivation in their training[24,25], while our study did not. Such empowerment and motivation could have helped the patients feel more motivated and confident in their capability to perform health behavior to prevent infection.

This study had certain limitations. With a simple random sampling of the week of the month followed by match-paired selection, not randomization at the individual patient level, therefore full randomization could not be achieved, and potential bias could be expected. Other factors could also affect knowledge, actual practice and CAPD related infection of the patient. These included healthcare services and information the patient received from other settings. Some patients had depression which could make the patient lose interest in self-care hence the actual practice of CAPD was defective, for example, no desire to change the dialysis solution on time, to clean the exit-site, or to take medications and diet as prescribed. In addition, differences in the characteristics and capability of caregivers of the two groups could also affect the patient's knowledge, actual practice and infection. Finally, since the incidence of CAPD related infection within 12 weeks was relatively low in both groups, the sample size in this could be relatively small. Therefore, future study should enroll a larger sample size.

Our findings and conduct could shed some light on future research and practice. Multidisciplinary team should be promoted to be more available for proving knowledge and practice training to prevent CAPD related infection. Knowledge and training could be provided various means including group

education, individual patient education, telephone call follow-up, online video conference, and home visit. In this multidisciplinary team, pharmacist should be included to identify drug related problems every time the patient meets the physician. This is because regular monitoring on drug use and prescribing could help identify, solve and prevent drug related problems, and improve medication compliance. However, more training on pharmacists for medication management in CAPD patients should be in place therefore more pharmacists are better equipped to work with multidisciplinary team. In terms of future research, in addition to a larger sample size as mentioned above, a longer study duration of 6 months or 1 year should be considered to better capture CAPD infection incidence. Economic assessment on the patient training by multidisciplinary team to prevent CAPD related infection should also be conducted.

The Training Program by Multidisciplinary Team for Infection Prevention of CAPD (TPMTIP) resulted in more knowledge in preventing CAPD related infection with statistical significance (*P*-value < 0.001), more proper practice in CAPD steps, less drug related problems, and less incidence of CAPD related infection compared with the usual care even though statistical significance was not reached.

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