Prevalence and Factors Affecting Peritonitis in CAPD Patients in Maharat Nakhon Ratchasima Hospital under Universal Coverage Scheme during 2008-2010: A Three-Year Experience

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Objective: *Since 2008, the Thai government has subsidized the package to cover chronic ambulatory peritoneal dialysis (CAPD) for end stage renal disease (ESRD) patients under the universal coverage scheme (UCS) in Thailand. The aim of the program is to keep longer life in poor people instead of death due to inaccessibility to renal replacement therapy as usual. The present study was conducted to evaluate the prevalence and factors affecting peritonitis in patients with CAPD therapy under the UCS at Renal unit, Maharat Nakhon Ratchasima Hospital, during January 1, 2008-December 31, 2010.*

Material and Method: *Medical records of ESRD patients undergoing CAPD under UCS at Maharat Nakhon Ratchasima Hospital during January 1, 2008-December 31, 2010 were reviewed. The collected data included demographic details, underlying diseases, body mass index (BMI), laboratory findings, peritonitis rate, and outcome of therapy at December 31, 2010.*

Results: *There were 318 ESRD patients with the mean age of 49.9 $\pm$ 14.3 years and mean BMI of 23.1 $\pm$ 3.9 kg/m^2. The common causes of ESRD were hypertension (60.1%) and diabetes mellitus (34.9%). In the follow-up period, 318 patients received the treatment over a total observation period of 3,262.2 patient-months. The patient survival was 51.0% at 3 years. Most of the patients (74.8%) had no peritonitis. There were 128 peritonitis episodes. The mean duration from starting CAPD to the first episode of peritonitis was 25.5 patient-months per episode. Staphylococcus spp. was the most common organism causing peritonitis which is the major cause of technical failure. The factors affecting peritonitis is included age > 60 years, hypokalemia (< 3.5 mEq/L), and hypoalbuminemia (< 3.5 g/dl).*

Conclusion: *To improve clinical outcome of CAPD patients by decreasing the peritonitis rate, the factors affecting peritonitis should be corrected. The patients and care-givers should also be educated about the importance of hygiene and exchanging methods to decrease the peritonitis rate in CAPD patients*

Keywords: *Continuous ambulatory peritoneal dialysis, Aging, Hypokalemia, Hypoalbuminemia*

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The prevalence of end stage renal disease (ESRD) has increased every year[1,2]. The standard treatment of ESRD is renal replacement therapy (RRT) including hemodialysis (HD), continuous ambulatory peritoneal dialysis (CAPD), and kidney transplantation (KT)[3-5]. In the first 2 years, the survival rate for peritoneal dialysis is better than HD and then are similar in long term survival[6]. All modalities of RRT are high-cost medical treatments.

In Thailand, there are three main health care schemes providing health care to population, including the universal coverage scheme (UCS), the social security scheme (SSS), and the civil service medical benefits scheme (CSMBS). Since 2008, the Ministry of Public Health of Thailand was strongly supported by the National Health Security Office (NHSO) to extend a benefit package to cover CAPD for ESRD patients under UCS. Consequently, ESRD patients who decided to choose CAPD were registered at each center.

Peritonitis is one of the most common complications of CAPD and a leading cause of technical failure and catheter loss[7,8]. The incidences of

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peritonitis vary between centers but are expected to decline in the future[9].

In Maharat Nakhon Ratchasima Hospital, the CAPD program under UCS has been started since 2008. The present studies was carried out to determine the peritonitis rate and to evaluate factors affecting peritonitis in the patients.

Material and Method

Medical records of 318 new adult ESRD patients who underwent CAPD under UCS in Maharat Nakhon Ratchasima Hospital during January 1, 2008-December 31, 2010 were reviewed. All of the patients were administered intraperitoneal antibiotics after catheter insertion.

Inclusion criteria comprised all of the adult CAPD patients under UCS who registered and followed-up at CAPD clinic since January 1, 2008 at Maharat Nakhon Ratchasima Hospital until death, change to hemodialysis or kidney transplantation modalities, referral to other centers, or until December 31, 2010. Technique failure was defined by changing the treatment to hemodialysis or removing the Tenchkoff catheter.

Exclusion criteria were patient's age below 15 years and patients who refused to follow-up at CAPD clinic in Maharat Nakhon Ratchasima Hospital.

Data collection consisted of demographic details, underlying diseases, body mass index (BMI), laboratory findings, including hemoglobin, hematocrit, serum electrolyte, serum calcium, serum phosphate, serum albumin, parathyroid hormone (PTH), and peritonitis rate.

Statistical analysis

All data were expressed as percentage, mean, SD, and Chi-square. Survival analysis was performed by Kaplan-Meier analysis for peritonitis free episode. Comparisons of the survaival curves were made using log rank test.

Results

Three hundred and eighteen ESRD patients fulfilled the inclusion criteria. The baseline clinical characteristics were shown in Table 1. Tenckhoff catheters were inserted by nephrologists in 73.3% and by surgeons in 26.7%. During 2008-2010, these 318 CAPD patients were followed-up for a total observation period of 3,262.2 patient-months.

One hundred and sixty-seven patients (52.5%) had hemoglobin below 10 g/dl. Ninety-six patients (30.2%) had serum potassium less than 3.5 mEq/L. One hundred and seventy-two patients (54.1%) had serum albumin levels below 3.5 g/dl. Seventy-four patients (23.3%) had parathyroid hormone levels below 150 pg/dl while 42 patients (13.2%) had parathyroid hormone levels above 300 pg/dl.

As illustrated in Table 3 and Table 4, most of the patients (74.8%) had no peritonitis during the follow-up period. There were 128 peritonitis episodes. The mean duration from starting CAPD to the first episode

Table 1. Baseline clinical characteristics of CAPD patients

Baseline clinical characteristics	Cases (%)
Gender	
male	162 (50.9%)
female	156 (49.1%)
Mean age ± SD year (range)	49.9 ± 14.3 (15.3-82.8)
Underlying disease	
Hypertension	191 (60.1%)
Diabetic mellitus	111 (34.9%)
Chronic glomerulonephritis	37 (11.6%)
Gout	29 (9.1%)
Ischemic heart disease	21 (6.6%)
Cerebrovascular disease	11 (3.5%)
Renal calculi	9 (2.8%)
Valvular heart disease	8 (2.5%)
Systemic lupus erythematosus	6 (1.9%)
Infection	14 (4.4%)
Hepatitis B carrier	7 (2.2%)
Hepatitis C carrier	3 (0.9%)
HIV infection	4 (1.3%)
Other diseases	10 (3.1%)
Unclassified renal diseases	18 (5.7%)

Table 2. Average values of laboratory parameters during the study period

Laboratory findings	Mean ± SD (range)
Body mass index (± SD) kg/m^2 (range)	23.1 ± 3.9 (16.2-40.1)
Hemoglobin (g/dl)	9.4 ± 1.8 (4.5-19.2)
Hematocrit (vol%)	28.1 ± 5.2 (11.0-43.0)
Serum potassium (mEq/L)	3.7 ± 0.7 (1.9-6.0)
Serum albumin (g/dl)	3.2 ± 0.5 (1.9-4.3)
Serum calcium (mg/dl)	8.8 ± 0.9 (5.1-12.7)
Serum phosphate (mg/dl)	4.7 ± 1.7 (1.6-14.7)
Parathyroid hormone (pg/dl)	256.6 ± 296.5 (7.1-2,722.2)

of peritonitis was 25.5 patient-months per episode. Regarding causative organisms, approximately 60% of peritonitis had negative culture. *Staphylococcus spp*. were the most common organism that caused peritonitis, relapsed peritonitis, and changing to hemodialysis.

Table 5 demonstrates subgroup univariate analysis factors affecting peritonitis free survival time. Thus, age above 60 years (Fig. 1), hypokalemia (< 3.5 mEq/L) (Fig. 2), and hypoalbuminemia (< 3.5 g/dl) (Fig. 3) had lower mean peritonitis free survival time. Other variables such as diabetes mellitus, body mass index, hemoglobin, and parathyroid hormone level had no significant effect on the mean peritonitis free survival time.

At December 31, 2010, the patient survival was 51.0% with the mean patient survival time of 34.2 ± 2.0 months. The mean catheter survival time was 27.4 ± 2.2 months with the median value of 21.8 months. Technical failure rate was 9.3%. The causes of technique failure were relapsed peritonitis, abdominal hernia, adhesion, ultrafiltration failure, subcutaneous dialysate leakage, and malposition. The causes of death included sepsis (33.7%), congestive heart failure (4.7%),

Table 3. Peritonitis episodes in CAPD patients during January 1, 2008-December 31, 2010

Peritonitis episodes	Number of patients (%)
No peritonitis	226 (74.8)
1 episode	46 (15.2)
2 episodes	18 (6.0)
3 episodes	6 (2.0)
4 episodes	2 (0.7)
5 episodes	4 (1.3)

Table 4. Causative organisms of peritonitis/episode

Organisms	Episodes (%)
Negative culture	77 (60.2)
Gram positive organisms	31 (24.2)
Staphylococcus aureus (SA)	9 (7.0)
Staphylococcus coagulase negative	5 (3.9)
Multi-drug resistant SA (MRSA)	4 (3.1)
Streptococcus spp.	9 (7.0)
Bacillus spp.	2 (1.6)
Enterococcus spp.	1 (0.8)
Corynebacterium spp.	1 (0.8)
Gram negative organisms	20 (15.6)
E.coli	6 (4.7)
E.coli (ESWL)	1 (0.8)
Klebsiella pneumoniae	6 (4.7)
Klebsiella pneumoniae(ESWL)	1 (0.8)
Acinetobacter spp.	3 (2.3)
Pseudomonas stuzeri	1 (0.8)
Pantoea aggluneraus	1 (0.8)
Enterobacter cloacae	1 (0.8)

Table 5. Subgroup analyses of time to peritonitis

Variable	Mean peritonitis free survival time (months)	p-value
Age		
< 60 years	27.5	< 0.05
≥ 60 years	13.5	
Comorbid disease		
Non-diabetes mellitus	25.7	0.35
Diabetes mellitus	26.9	
Body mass index		
< 18.5 kg/m^2	27.7	0.61
18.5-23.0 kg/m^2	26.3	
> 23.0 kg/m^2	25.1	
Hemoglobin		
< 10 g/dl	21.6	0.62
≥ 10 g/dl	25.4	
Serum potassium		
< 3.5 mEq/L	16.2	< 0.05
≥ 3.5 mEq/L	28.1	
Serum albumin		
< 3.5 g/dl	21.6	< 0.05
≥ 3.5 g/dl	32.1	
Parathyroid hormone		
< 150 pg/dl	24.1	0.21
150-300 pg/dl	28.5	
≥ 300 pg/dl	28.7	

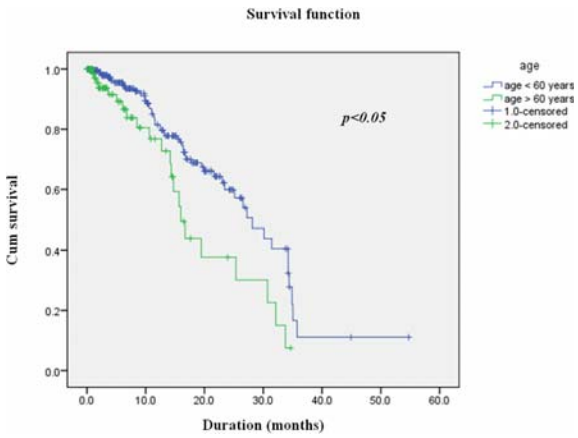

Fig. 1 Time to peritonitis analyses, Kaplan-Meier survival analysis by age

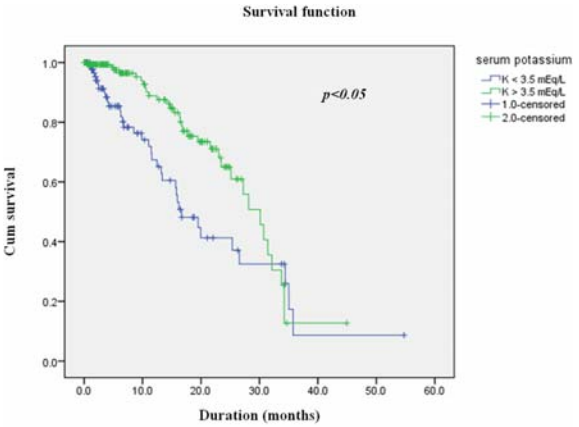

Fig. 2 Time to peritonitis analyses, Kaplan-Meier survival analysis by serum potassium

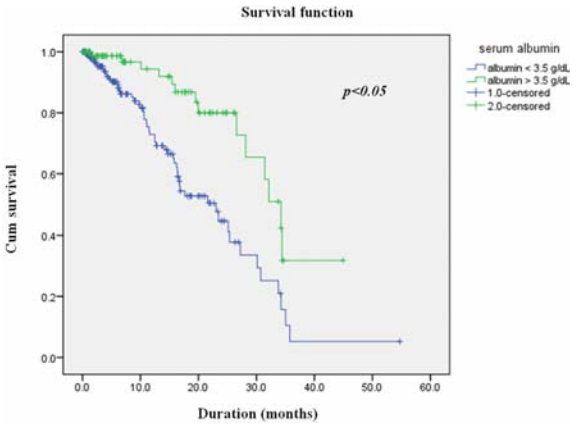

Fig. 3 Time to peritonitis analyses, Kaplan-Meier survival analysis by serum albumin

pneumonia (3.5%), cerebrovascular accident (2.3%), abdominal bleeding (2.3%), and unknown (50%).

Discussion

The standard guidelines for management in ESRD is RRT[3-6]. Huang et al showed that the survival rate of PD was better than that of HD in the first two years but no significant difference was noted in long term follow-up[6]. Peritonitis is a common clinical problem occurring in patients with ESRD treated with PD. Although the incidence of peritonitis varies from center to center, it has progressively declined since 1980s, and during the past decade approximately 1 episode per 24 patient-months was routinely observed. In some centers, 1 episode per 60 patient-months has been achieved[9-11]. In the past, peritonitis was a leading cause of mortality, approximately 0.8-12.5%, in CAPD patients[12]. Earlier studies showed that the factors associated with increased risk of peritonitis were low baseline serum albumin[13,14] and anemia[15].

In the present study, the mean duration from starting CAPD to the first episode of peritonitis was 25.5 patient-months per episode. Of the 128 peritonitis episodes, the causative organism could not be cultured in the majority of cases (60.2%). This might be related to the method of dialysate collection for culture. In the present study, sterile hemoculture bottle was utilized for the collection. This might be the reason why the rate of negative culture of peritonitis was quite high in the present study. That *Staphylococcus spp.* and *Streptococcus spp.* were the two most common causative organisms of peritonitis were similar to a previous study[16]. The most common organisms of relapsed peritonitis that were caused by *Staphylococcus aureus*, *Staphylococcus coagulase negative* and MRSA. The relapsed peritonitis was an important etiology of technical failure and could cause removal of the catheter. As such, it is crucial to find out the source of *Staphylococcus aureus, e.g.* nasal cavity, and the care giver needed to be trained about PD technique and dressing care for patients. In the present study the factors associated with increased risk of peritonitis were eldery patients (age $\geq$ 60 years), hypoalbumine-mia (serum albumin < 3.5 g/dl), and hypokalemia (serum potassium < 3.5 g/dl). Previous studies had demonstrated affected factors for peritonitis in CAPD patients such as *hypoalbuminemia*[13,14], *hypokalaemia*[17], *anemia*[15], and *diabetes mellitus*[17]. The reasons for increasing risk peritonitis by these factors were still unclear. Elderly CAPD patients may have poor immune response while *hypoalbuminemia* may be associated with *malnutrition*. *Hypokalemia* may induce dysmotility of the intestinal tract and, in turn causes bacterial overgrowth and subclinical translocation of enteral bacteria[17]. Of interest, anemia was not the affecting factor that increased risk to peritonitis in the present study. In the previous study, anemia was defined as hemoglobin below 12 g/dl[15] while in the present study anemia was defined when hemoglobin was lower than 10 g/dl. Since most of the CAPD patients in the present study had hemoglobin below 10 g/dl, significant differentiation between hemoglobin groups might not be obviously identified.

In conclusion, to decrease the peritonitis rate and improve clinical outcome of CAPD patients, the correctable factors affecting peritonitis, including hypokalemia and hypoalbuminemia, should be treated.

Education regarding the importance of hygiene and exchanging methods to the patients and care-givers are mandatory.

Potential conflicts of interest

None.

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อุบัติการณ์และปัจจัยที่มีผลต่อการติดเชื้อในช่องท้องของผู้ป่วยล้างไตทางช่องท้องภายใต้ระบบประกันสุขภาพถ้วนหน้าในโรงพยาบาลมหาราชนครราชสีมา: ปี พ.ศ. 2551-2553

วราภรณ์ เลียวนรเศรษฐ

***วัตถุประสงค์**: ตั้งแต่ต้นปี พ.ศ. 2551 เป็นต้นมา รัฐบาลอนุมัติให้ผู้ป่วยโรคไตเรื้อรังระยะสุดท้ายภายใต้โครงการประกันสุขภาพถ้วนหน้าสามารถเข้าถึงการรักษาด้วยวิธีการล้างไตทางหน้าท้อง โดยไม่เสียค่าใช้จ่าย โดยหวังให้ผู้ป่วยมีอายุยืนยาวขึ้น ทำการศึกษานี้เพื่อประเมินอุบัติการณ์ และปัจจัยที่มีผลต่อการติดเชื้อในช่องท้องของผู้ป่วยไตวายระยะสุดท้าย ที่เข้าร่วมโครงการล้างไตทางช่องท้องภายใต้ระบบประกันสุขภาพถ้วนหน้าที่หน่วยไตโรงพยาบาลมหาราชนครราชสีมา ระยะเวลา 3 ปี*

***วัสดุและวิธีการ**: ศึกษาข้อมูลผู้ป่วยไตวายเรื้อรังระยะสุดท้ายที่ล้างไตทางช่องท้องรายใหม่ภายใต้ระบบประกันสุขภาพถ้วนหน้าที่หน่วยไตโรงพยาบาลมหาราชนครราชสีมา ระหว่างวันที่ 1 มกราคม พ.ศ. 2551-วันที่ 31 ธันวาคม พ.ศ. 2553 โดยเก็บข้อมูลพื้นฐาน โรคประจำตัว ดัชนีมวลกาย ผลตรวจทางห้องปฏิบัติการ อัตราการติดเชื้อในช่องท้องและอัตราตาย*

***ผลการศึกษา**: พบผู้ป่วย 318 ราย อายุเฉลี่ย 49.9 $\pm$ 14.3 ปี ดัชนีมวลกาย 23.1 $\pm$ 3.9 กิโลกรัมต่อตารางเมตร สาเหตุของโรคไตที่พบบ่อยได้แก่ โรคความดันโลหิตสูง ร้อยละ 60.1 และโรคเบาหวาน ร้อยละ 34.9 มีผู้ป่วย 318 ราย ที่ได้รับการติดตามการรักษาตลอดระยะเวลาในการศึกษาทั้งหมด 3,262.2 ผู้ป่วย-เดือน อัตรารอดชีวิตผู้ป่วยเท่ากับ ร้อยละ 51.0 ที่ 3 ปี, ผู้ป่วยส่วนใหญ่ (ร้อยละ 74.8) ไม่มีการติดเชื้อในช่องท้อง มีการติดเชื้อ 128 ครั้ง ค่าเฉลี่ยระยะเวลาปลอดจากการติดเชื้อในช่องท้องเท่ากับ 25.5 ผู้ป่วย-เดือน เชื้อก่อโรคที่พบบ่อยได้แก่ เชื้อกลุ่มสแตฟไฟโลค็อกคัส และเป็นสาเหตุสำคัญของความล้มเหลวทางเทคนิค ปัจจัยที่มีผลต่อการติดเชื้อได้แก่ อายุมากกว่า 60 ปี, ภาวะโพแทสเซียมต่ำกว่า 3.5 มิลลิอิควิวาเลนท์/เดซิลิตร, ภาวะแอลบูมินในเลือดต่ำกว่า 3.5 กรัม/เดซิลิตร*

***สรุป**: เพื่อให้ผลลัพธ์ในการรักษาผู้ป่วยโดยการลดอัตราการติดเชื้อในช่องท้อง จึงควรแก้ไขปัจจัยดังกล่าว การให้ความรู้แก่ผู้ป่วยและผู้ดูแลผู้ป่วยตระหนักถึง ความสำคัญของสุขอนามัย และการเปลี่ยนน้ำยาอย่างถูกวิธี น่าจะช่วยลดอัตราการติดเชื้อในช่องท้องได้*