The Incidence of Peritoneal Dialysis-Related Infection in Thailand: A Nationwide Survey

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Objective: *Implementation of the "Peritoneal Dialysis-First (PD First)" policy, mandating PD as the first modality of renal replacement therapy for end-stage renal disease patients under universal health coverage, leads to a rapid growth of PD cases and centers in Thailand. Since PD-related infection is the Achilles' heel of PD, this retrospective study was conducted to examine the magnitude of PD-related infection in Thailand under the "PD First" policy.*
Material and Method: *All PD centers in Thailand were included in the present study. PD nurse specialists in each center were requested to review medical records of all patients undergoing PD during October 1, 2009 to September 30, 2010 and to submit data to the main investigators.*
Results: *Eighty-eight percent of all active PD-centers in Thailand (102 out of 116) participated in the present study. One hundred and thirty-three nephrologists and 220 PD nurse specialists served 8,201 PD prevalent patients in these centers (7,925 CAPD and 276 APD). The overall exit-site infection (ESI) rate was 1 episode/ 37.7 patient-month (0.32 episodes/ patient-year) while the overall peritonitis rate was 1 episode/ 25.5 patient-month (0.47 episode/patient-year).*
Conclusion: *Despite the rapid growth of PD cases under the limited resource, the PD-related infection rates in Thailand are only small degree behind the goal of Asia-Pacific Key Performance Indicators (KPIs) Task Force.*

Keywords: *Peritoneal dialysis-related infection, Peritonitis rates, Exit-site infection rate, PD First policy*

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Data from the Thai Renal Replacement Therapy (TRT) Registry in 2008 revealed that the prevalence of chronic peritoneal dialysis (PD) population in Thailand was nearly 3,000 cases (9.5% of dialysis population) in 103 centers. Most of the PD patients received standard continuous ambulatory peritoneal dialysis (CAPD; 89.6%), the others underwent automated PD (APD; 10.4%)[1]. The number of new PD patients soars recently due to the "PD First" national health policy[2].

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From the earlier report by Chanma et al[3], the incidence of PD-related peritonitis in 23 PD centers of Thailand, the pilot PD centers of the "PD First" policy, between October 2007 and April 2009 was at 0.3 episodes/patient-year or 40 months/episode. However, several PD centers experienced high drop-out rate (up to 32%, non-published data). Siriwong[4] reported that the number of cumulative PD cases over three-year after implementation of the "PD First" policy was 10,031 while there were 7,521 currently active PD cases in 108 centers by November 2010. A large proportion of the drop-out cases (2,510 cases; 25%) were noted. Majority of the cases were related to the infections (unpublished data). Therefore, the authors re-examined the situation of PD-related peritonitis in Thailand during the maturation of the "PD First" program by pooling the peritonitis rate and exit-site infection (ESI) rate from

102 active PD centers throughout the country.

Material and Method

PD case manager from active PD center (116 centers) throughout the country were invited to participate the present study by answering the questionnaire regarding to the PD-relate infections (peritonitis and ESIs) during October 1, 2009 to September 30, 2010. All demographic data and clinical outcomes including causative microorganisms were additional submitted to the main investigators. The validity of data was cross-checked with the mandated NHSO registry system and was reciprocal checked with direct communication via phone and email to the PD case manager or in-charge doctor in the center with data in doubt.

Case definition

Peritonitis was defined by the presence of at least two of the following criteria: (a) abdominal pain, (b) cloudy appearance of drainage effluent with white blood cell count more than 100/mm^3 and 50% predominate neutrophils, and (c) a positive isolated organisms by culture or gram stain of the effluent[5].

Exit site infection was defined by the presence at least two of the following: erythema more than 2 cm, pain, or purulent discharge[6].

Statistical analysis

Data were expressed as number (percentage) and mean $\pm$ standard deviation (SD) unless otherwise specified. Peritonitis and ESI rates were calculated from the episodes of infections and the patient-months of PD treatment which were finally expressed as months per episode.

Results

Eighty-eight percent of all PD-centers in Thailand (102 out of 116) participated in the present study. Seven thousand nine hundred and twenty-five (96.6%) patients underwent CAPD, while 276 patients (3.4%) were on APD. One hundred and thirty three nephrologists and 186 certified PD nurse specialists served 8,201 prevalent (6,453 active) PD patients in these centers (Table 1).

During one year of the study period, 2,420 episodes of PD-related peritonitis were identified in 61,767 patient-months from 96 centers. Therefore, overall peritonitis rate was one episode per 25.5 patient-months or 0.47 episodes per patient-year. Of note, 23

Table 1. Demographic and clinical data of peritoneal dialysis centers

Characteristics	
PD center (total = 102)	
Primary-care (community-based) hospital	10
Secondary-care hospital	50
Tertiary-care (referral) hospital	24
University hospital	13
Special (private, military or police) hospital	5
PD center experience (month)	68.4 (4-360)
Number of nephrologists	133
Number of surgeon	181
Number of peritoneal dialysis-trained nurses	186
Type of peritoneal dialysis, (%)	
Continuous ambulatory	7,925 (96.6)
Automated	276 (3.4)
Type of reimbursement schemes (%)	
Universal coverage	7,401 (90.3)
Social security	111 (1.3)
Government/State enterprises	678 (8.3)
Self-support	11 (0.1)
Number of prevalence case	8,201
Number of active case	6,453
Number of incidence case	4,513
Number of drop-out (included kidney transplant)	2,037

centers (24.0%) had peritonitis rate greater than 1 episode every 18 months (0.67/year at risk) and only 16 centers (17%) achieved the goal of unofficially published Asia-Pacific Key Performance Indicators (KPIs) presented by Dr. David Johnson, at the level of lesser than 1 episode every 40 months (0.3/year at risk). One thousand episodes from 39 centers were available for assessing the pathogen. The most common identified causative pathogen was gram positive bacteria (29.8%) followed by gram negative fermentative rods bacteria (21.7%) (Table 2). However, 34.5% of the episodes were negative culture. Many centers (14 out of 65 centers) reported the culture-negative rate of greater than 50% of the total episode. In addition, only one third of the center (20 in 65 centers) could achieve the culture-failure rate recommended by the International Society for Peritoneal Dialysis (ISPD) of less than 20%.

One thousand two hundred and sixty-eight episodes of ESIs were identified in 47,791 patient-months from 74 centers. Accordingly, overall ESIs rate was one episode per 37.7 patient-months or 0.32 episodes/patient-year. Almost half of the center (34 out of 74) had the ESI rate higher than the expectation of the Asia-Pacific KPIs (50 patient-month/episodes or 0.24 episode/patient-year). The major pathogens causing ESIs were *Staphylococcus aureus* and *Staphylococcus epidermidis.*

Discussion

PD-related peritonitis is one of the major KPIs in PD. Fried et al found that peritonitis was an independent risk factors for death[7]. Furthermore, peritonitis is a serious complication of PD and probably the most common cause of technical failure in PD[8,9]. In epidemiologic data from the United States, nearly 20% of the infection-related mortality in PD patients resulted from peritonitis[10]. Although less than 4% of peritonitis episodes resulted in death, PD-related peritonitis was accounted for 16% of death in PD patients[11,12]. Therefore, the effective prevention strategies to reduce peritonitis in PD patients are important goals.

In the present study, the authors found a relatively high peritonitis rate, higher than the pre- "PD First" era, suggesting that PD-related peritonitis was the very important issue in the authors "PD First" program. The infection rate for both ESIs and PD-related peritonitis in the present study were over 1.5-2 folds higher than the previous reports[4].

Table 2. Causative microorganisms identified in PD-related peritonitis cases

Isolated microorganism (s)	n (%)
Gram-positive bacteria	298 (29.8)
Staphylococcus aureus	103
Staphylococcus epidermidis	95
Streptococcus spp.	35
Enterococcus spp.	12
Bacillus/Diphtheria/Listeria spp.	43
Gram-negative fermentative rods	217 (21.7)
Escherichia coli	86
Klebsiella pneumoniae	41
Enterobacter spp.	28
Serratia spp.	9
Citrobacter freundii	2
Edwardsiella tarda/Aeromonas spp.	4
Gram-negative non-fermentative rods	84 (8.4)
Pseudomonas aeruginosa	51
Acinetobacter baumannii	19
Pseudomonas/Stenotrophomonas/Brevundimonas spp.	14
Fungus	39 (3.9)
Mycobacteria	
Mycobacterium tuberculosis	5 (0.5)
Polymicrobial	11 (1.1)
Negative culture	345 (34.5)

According to the Asia-Pacific KPIs, the goal of PD-related peritonitis rate in a PD center should not be lower than 40 patient-months/episode (0.30 episode/year)[5]. However, only one fifth of the centers accomplished the target. Despite the lower threshold of peritonitis rate (no more than 1 episode every 18 months or 0.67/year at risk), recommended by the ISPD in the year 2010, one fourth of the centers failed the goal. Thus, all stakeholders should raise a red flag and put much effort to deal with this active problem. Although the present study showed that several institutes had a multiple episodes of PD-related peritonitis during the present study period, these PD centers may gain up their expertise and eventually provide the better PD care in the near future since the outcome improvement was correlated with time of service[13].

The authors found that the most causative microorganisms were *Staphylococcus aureus* and *Staphylococcus epidermidis*. The results were consistent with other reports[14-16]. This could indirectly imply that the infection resulted from poor aseptic technique and poor individual hygiene[17]. Organizing the more frequent intensive education and re-training patients and caregivers may be a useful strategy to deal with this weak point. The most common gram negative pathogen was *Escherichia coli* followed by *Pseudomonas aeruginosa.* It was unexpected to find large numbers of negative-culture peritonitis episode (34.5%). Of note, many centers reported the prevalence of greater than 50%. The prevalence is higher than the threshold of the ISPD's and Asia Pacific KPIs' which allow the prevalence not to be greater than 20%, and 15%, respectively. This information urges us all to urgently improve culture technique of the whole nation.

The incidence of fungal peritonitis was quite high (approximately 6.0% of culture-positive episode). The reasons for this phenomenon remained unestablished. It was possible that the combination of low patient immunological status in ESRD, the too liberal over-the-counter prescription of antibiotics in Thailand, and aggressive infection treatment without antifungal prophylaxis were the possible explanation. Surprisingly, this report also documented uncommon peritonitis pathogens related to water or aquatic creature exposures, *Edwardsiella tarda* and *Aeromonas spp*. It has been associated in case-control studies with diarrhea and can cause wound infections, abscesses, and bacteremia[18,19].

The present study has several limitations. The accuracy of the data may affect the results of the present study since data collection methods were not closely controlled. The data may also be variable due to the relaxed definition of PD-related infection in each individual center. In practice, the cloudy appearance of PD effluent usually motivates the clinician to initiate empiric antibiotics and stigmatize peritonitis in records without proper confirmation. Finally, there are myriad factors, such as use of over-the-counter antibiotic drugs that might contribute to the undiagnosed and undocumented PD-related infection cases.

In conclusion, the present study revealed the high magnitude of PD-related infectious problems in Thailand. These complications will certainly be a big trouble to Thailand health care system that recently opt the "PD First policy". All stakeholders should put their maximum effort to improve the prevention and treatment PD-related infection in Thailand.

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Potential conflict of interest

None.

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อุบัติการณ์ของการติดเชื้อที่สัมพันธ์กับการล้างไตทางช่องท้องในประเทศไทย: งานสำรวจทั้งประเทศ

เถลิงศักดิ์ กาญจนบุษย์, วิวัฒน์ จันเจริญฐานะ, พิสุทธิ์ กตเวทิน, สุชาย ศรีทิพยวรรณ, เกื้อเกียรติ ประดิษฐ์พรศิลป์, สุรพล อริยปิติพันธุ์, สมชาย เอี่ยมอ่อง, ประทีป ธนกิจเจริญ, ดุสิต ล้ำเลิศกุล

วัตถุประสงค์: *การประกาศใช้นโยบาย "พีดี-เฟิรสท์" สนับสนุนให้ผู้ป่วยไตวายเรื้อรังระยะสุดท้ายเลือกใช้การล้างไตทางช่องท้องเป็นวิธีแรกภายใต้โครงการหลักประกันสุขภาพถ้วนหน้า ก่อให้เกิดการเพิ่มขึ้นของผู้ป่วยล้างไตทางช่องท้องและศูนย์บริการอย่างมากในประเทศ ด้วยเหตุที่การติดเชื้อที่สัมพันธ์กับการล้างไตทางช่องท้อง มีความสำคัญอย่างมากต่อความสำเร็จของการทำพีดี คณะผู้นิพนธ์จึงเห็นพ้องทำการสำรวจความรุนแรง ของอุบัติการณ์ในประเทศหลังประกาศใช้นโยบาย "พีดี-เฟิรสท์"*

วัสดุและวิธีการ: *ทำหนังสือเชิญชวนให้พยาบาลผู้จัดการศูนย์บริการพีดีทั้งประเทศ ทำการทบทวนประวัติการรักษาผู้ป่วยพีดีของตนเองในปีงบประมาณ พ.ศ. 2553 โดยเฉพาะ อัตราการติดเชื้อของช่องท้อง และอัตราการติดเชื้อของช่องทางออกของสาย และส่งผลการสำรวจมาให้คณะผู้นิพนธ์ ซึ่งข้อมูลที่ได้จะถูกนำมาตรวจสอบความถูกต้องด้วยฐานข้อมูลของ สำนักงานหลักประกันสุขภาพแห่งชาติ และติดต่อกับไปยังผู้กรอกข้อมูลและอายุรแพทย์ผู้ดูแลศูนย์*

ผลการศึกษา: *พบว่าร้อยละ 88 ของศูนย์ที่เปิดบริการร่วมมือให้ข้อมูล (102 ศูนย์จากทั้งหมด 116 ศูนย์) โดยมีอายุรแพทย์ โรคไตทำงานอยู่ในศูนย์รวมทั้งสิ้น 133 ราย พยาบาลผู้เชี่ยวชาญและผ่านการอบรมหลักสูตรการพยาบาลผู้ป่วย ล้างไตทางช่องท้องจำนวน 220 ราย และผู้ป่วยรวม 8,194 ราย (รวมจำนวนผู้ที่ออกจากโปรมแกรม) เป็นผู้ป่วยที่ล้างไต ทางช่องท้องด้วยตนเอง 7,918 รายและผู้ที่ล้างไตด้วยเครื่องมืออัตโนมัติจำนวน 276 ราย พบว่าอัตราการติดเชื้อ ของช่องทางออกของสายเท่ากับ 1 ครั้งทุก 37.7 เดือน หรือเท่ากับ 0.32 ครั้ง/ปี และอัตราการติดเชื้อของช่องท้องเท่ากับ 1 ครั้ง ทุก 25.6 เดือนหรือเท่ากับ 0.47 ครั้ง/ปี*

สรุป: *ถึงแม้ว่าอัตราการเติบโตของผู้ป่วยล้างไตทางช่องท้องจะเพิ่มขึ้นอย่างรวดเร็วในระยะเวลา 2-3 ปีที่ผ่านมา ทั้งๆที่อยู่ในสภาวะที่มีข้อจำกัดหลายประการ แต่พบว่าอุบัติการณ์ของการติดเชื้อที่สัมพันธ์กับการล้างไตทางช่องท้องต่ำกว่ามาตรฐานที่กำหนดโดยคณะทำงานทวิภาคีเอเชีย-แปซิฟิก เพื่อสร้างตัวชี้วัดคุณภาพของศูนย์ล้างไตทางช่องท้องไม่มากนัก*