Peritoneal Dialysis Failure and its Impact on Holistic Kidney Care: A Case Report

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Abstract

Introduction: Peritonitis remains the primary cause of treatment failure among patients with end-stage kidney disease on continuous ambulatory peritoneal dialysis. However, detailed case analyses illustrating the application of current research in clinical practice remain scant. This case report aimed to elucidate the roles of dialysis nurses in a hospital setting in the management of a 62-year-old male patient with a history of kidney failure secondary to amyloidosis.

Case Presentation: The patient was diagnosed with continuous ambulatory peritoneal dialysis-associated peritonitis.

Management and Outcomes: Dialysis nurses applied evidence-based practices in the management of the patient's exit-site infection, imbalanced nutrition, and psychosocial concerns. The patient was discharged after 7 days, with a comprehensive treatment regimen, including an individualized peritoneal dialysis protocol adjusted to his daily schedules, education on self-care techniques, and continual nutritional management to prevent recurrence and improve his overall health. This case report shows that admissions for continuous ambulatory peritoneal dialysis-associated peritonitis require evidence-based nursing interventions specific to, and geared toward, each patient's prioritized health problems.

Discussion: Peritonitis cases are preventable with appropriate nursing interventions that can lower the chance of treatment failure and long-term impact caused by an abrupt switch to hemodialysis. To successfully manage patients with continuous ambulatory peritoneal dialysis-associated peritonitis, dialysis nurses should appreciate the intricacies of the analyses underpinning their professional practices in promoting the patient's self-care techniques.

Introduction

Peritoneal dialysis (PD) is a renal replacement therapy that infuses a sterile solution within the peritoneal cavity via a catheter, allowing removal of water and solutes by employing the peritoneal membrane as an exchange surface (Tang & Lai, 2020). The solution, which closely contacts the peritoneum's capillaries, permits osmotic ultrafiltration water loss and diffusion in solute transport because it is hyperosmolar to plasma as a result of the addition of osmotic agents (most frequently glucose). There are two means whereby this solution can be infused into and drained from the peritoneal cavity: manually (continuous ambulatory PD [CAPD]), where the patient generally has the solution changed four times a day; or via the use of a machine (automated PD [APD]), with dialysis being undertaken using a cycling machine that permits the changes to be implemented as the patient sleeps overnight (Mizuno et al., 2016; Woodrow et al., 2017).

CAPD-associated peritonitis remains the leading cause of treatment failure, catheter removal, and changes in renal replacement therapy in patients on PD (Li et al., 2010). Hong Kong has the highest PD prevalence rate in the world (Liu et al., 2015), and the overall rate of CAPD-associated peritonitis has shown improvement, from ~22 patient months per episode in 1999 to 35.8 patient months per episode in 2011 (Kwong & Li, 2015). According to Li et al. (2016), peritonitis rates were commonly reported as the number of patient months per

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episode. This number can be calculated by dividing the total patient months of follow-up by the number of peritonitis episodes (Masakane et al., 2017). Dialysis care teams in Hong Kong provide care to a multitude of PD patients under the PD-first policy that has been implemented over 25 years (Wong et al., 2020), and their practical experience in managing CAPD-associated peritonitis may facilitate professional exchanges among dialysis nurses and practitioners worldwide. However, there is a paucity of in-depth case studies in the literature, particularly those illustrating the roles of dialysis nurses and detailed processes of nursing management in hospital settings.

Since patients with enhanced knowledge and better self-care techniques show better adherence to recommended treatment protocols and have lower PD-associated infection rates (Zhang et al., 2016), many peritonitis cases are preventable with appropriate nursing interventions (Chang et al., 2018). Thus, this case report aimed to bridge this knowledge gap by providing detailed descriptions of how dialysis nurses apply evidence-based strategies in clinical practice.

There is little research available from the last 20 years related to holistic nursing management of CAPD-associated peritonitis in patients with amyloidosis. Nevertheless, this is an important issue because studies have shown an association between patient survival rate and occurrence of catheter exit-site/tunnel infection and peritonitis in such patients (Koc et al., 2012).

The present case report describes a patient with end-stage kidney failure secondary to amyloidosis. Amyloidosis is a disorder characterized by soluble protein aggregation deposited as insoluble fibrils within extracellular tissues, resulting in progressive dysfunction of multiple organs (Gertz, 2020). The typical presentation comprises nephrotic syndrome leading to progressive renal impairment and finally end-stage renal failure (ESRF) (Kastritis et al., 2017).

Research has shown that patients with amyloidosis are significantly more likely to develop peritonitis ($p = .002$) and catheter exit-site/tunnel infection ($p = .018$) compared to patients with other etiologies of ESRF, including diabetes mellitus, chronic glomerulonephritis, and polycystic kidney disease (Koc et al., 2012). Catheter exit-site/tunnel infection has been reported as an independent predictor for patient survival (odds ratio: 0.250, $p = .015$) (Koc et al., 2012). In such patients, a significant correlation was found between the serum albumin level and mortality (Zakharova, 2015); therefore, hypoalbuminemia in patients with amyloidosis can predict an increased risk of patient death (Ahbap et al., 2014). Further, Koc et al.'s (2012) study demonstrated that catheter exit-site/tunnel infection was one of the significant and independent predictors of the survival rates of patients with amyloidosis.

This case uniquely exhibits two of the aforementioned independent predictors of heightened mortality (i.e., peritonitis/exit-site infection and imbalanced nutrition with concomitant hypoalbuminemia). The use of appropriate nursing strategies by dialysis nurses is essential to prevent undesirable adverse outcomes.

Case Presentation

Chief Complaint

A 62-year-old male patient with a history of kidney failure secondary to amyloidosis presented with chills, rigors, epigastric tenderness, and diarrhea. A tiny granuloma with scanty discharge at the exit site and a turbid peritoneal dialysate were observed the day before admission.

Medical History

He was anuric and had been on PD for 13 years, with a CAPD dialysis regimen as follows: 2.5% 2.5 L glucose dialysate with three exchanges in the daytime, plus an additional exchange with 7.5% 2 L icodextrin dialysate overnight. He performed CAPD bag exchanges himself and was known to have a history of glucose-6-phosphate dehydrogenase deficiency and hypertension. His CAPD regimen showed 600 mL/day of ultrafiltration, which was mainly attributable to icodextrin use. The International Society for PD released guidelines in 2000 regarding ultrafiltration failure (UF failure), which defined UF failure using the 3×4 rule (Mujais et al., 2000), which declares that ultrafiltration failure exists if net ultrafiltration is <400 mL following drainage of a 4% (3.86% or 4.25%, dependent on pharmacopeia) dialysis solution that has stayed intraperitoneally for 4 h. Thus, in this instance, ultrafiltration failure has not occurred.

A review of his home records indicated blood pressure readings ranging from 100/70 to 140/90 mmHg. Daily net ultrafiltration ranged from −400 to −900 mL, while the daily fluid intake was ∼500 mL.

Physical Examination

Upon admission, he had a fever of 38.5 °C and elevated blood pressure (150/83 mmHg). His heart rate was 78 bpm. His oxygen saturation (SpO$_2$) was 95% in ambient air. His body weight (without PD) was 57.8 kg, and his body mass index was 19.3 kg/m^2. No edema was noted. He had reduced appetite but good compliance with drug and fluid intake. On physical examination, there was guarding and abdominal rigidity, but bowel sounds were present. He had good knowledge of peritonitis, including probable entry routes, symptoms, and interventions for a suspected occurrence. Thus far, the overall clinical manifestations of this patient receiving PD (e.g., the new onset of abdominal pain as evidenced by the presence of abdominal guarding, fever, and appearance of cloudy effluent) strongly suggested the presence of CAPD-associated peritonitis (Salzer, 2018).

Table 1. Diagnostic Test Results.

Parameters	Results	Reference range	Interpretation
Hemoglobin	10.8 g/dL	13–17 g/dL	Anemia
Hematocrit	31.5%	40%–52%	Low volume of packed red blood cells
Sodium	132 mmol/L	135–145 mmol/L	Hyponatremia
Calcium	2.09 mmol/L	2.2–2.7 mmol/L	Hypocalcemia
Potassium	3.2 mmol/L	3.5–5 mmol/L	Hypokalemia
Phosphate	1.07 mmol/L	0.8–1.4 mmol/L	Normal
Albumin	30 g/L	35–50 g/L	Hypoalbuminemia
Creatinine	1,089 μmol/L	71–115 μmol/L	Increased, impaired kidney function
Urea	27.9 mmol/L	1.2–3 mmol/L	Increased, impaired kidney function

Test Results

Laboratory testing data are shown in Table 1. Hematologic investigations revealed anemia (hemoglobin 10.8 g/dL; hematocrit 31.5%), while a blood chemistry panel showed hyponatremia (132 mmol/L), hypocalcemia (2.09 mmol/L), hypokalemia (3.2 mmol/L), hypoalbuminemia (30 g/L), and significantly elevated creatinine (1,089 μmol/L), with an estimated glomerular filtration rate of 4.5 mL/min/1.73 m^2, signifying stage-5 chronic kidney disease.

The PD adequacy, as reflected by Kt/V$_{urea}$, was 1.78 weekly, which indicated borderline adequacy. Dialysis adequacy is a broad concept and includes fluid balance, small solute clearance, removal of uremic toxins of medium or large molecular weight, and maintenance of nutritional status. Kt/V$_{urea}$ is a consistent predictor of survival in PD patients (Canada-USA (CANUSA) Peritoneal Dialysis Study Group, 1996) and is, therefore, an important monitoring parameter. The total (peritoneal and kidney) small-solute clearance should be a total Kt/V$_{urea}$ of ≥1.7 per week (Szeto et al., 2019). The peritoneal equilibration test (PET) classified the patient as an average transporter (4 h dialysate to plasma ratio of creatinine [D/P creatinine], 0.791; 4 to 0 h dialysate glucose ratio [D/D0 glucose], 0.334). PET is used to characterize the capacity for transportation of the patient's peritoneal membrane (Wang et al., 2020). Transport capacity assists in deciding on the dwell time and is also a central factor in determining the morbidity and mortality of PD patients (Uncanin et al., 2020). Generally, patients with a high peritoneal transport status will find it beneficial to receive APD treatment employing lower dwell time, whereas patients with low peritoneal transport status may find treatments with longer dwell times, e.g., CAPD, more beneficial (Roumeliotis et al., 2020).

PD effluent showed the following cell counts: white blood cell (WBC), 3,157/mm^3; polymorphonuclear neutrophilic cell (PMN), 97%; lymphocytes, 3%; and eosinophils, 2%. A small amount of *Pseudomonas aeruginosa,* sensitive to gentamicin, was cultured from the exit site, and the PD effluent culture revealed a small amount of *Streptococcus mitis*, which was sensitive to penicillin G. Apart from these clinical elements, the provisional diagnosis of CAPD-associated peritonitis was confirmed by the presence of a dialysis effluent WBC count >100 cells/mm^3 (following a 120 min minimum dwell time) with PMNs >50% and positive effluent culture (Al Sahlawi et al., 2020; Li et al., 2016).

Psychosocial Assessment and Activities of Daily Living

The patient was able to complete the activities of daily living independently. There was a strong bond among family members, who provided physical and emotional support to the patient with his daily PD care. He lived with his wife and son, both of whom were incredibly supportive of the patient and provided constant assistance in delivering high-quality PD care at home.

The patient accepted that his kidney failure was a chronic illness. He remained the primary source of income for his family and was employed as an engineer at a construction company, which enabled him to be financially independent. He needed to perform one CAPD bag exchange at work daily. However, his work environment was not an ideal place for bag exchange because of the narrow space, dust, poor hygiene status, and central air-conditioning systems. During the patient interview, details regarding the hygiene status at work that may lead to CAPD-associated peritonitis were assessed. However, he could not leave his job and admitted that he did not turn off the fan or close doors and windows during CAPD bag exchanges because of the stuffy summer weather. Many researchers have demonstrated that airborne bacteria concentrations are correlated with airborne particulate matter (PM) concentrations (Lai et al., 2009) and that airborne PM can carry microorganisms (Cambra-Lopez et al., 2010). PD catheters represent a potential channel that allows pathogens to enter the peritoneal cavity from the atmosphere. When the PD catheters and dialysate bags are connected and/or disconnected, or the exit site is cleaned, the risk of infection with airborne microorganisms increases. Thus, PD patients performing exchanges in areas with high levels of environmental PM2.5 (PM2.5 relates to airborne droplets or particles with a diameter of <2.5 μm) experienced a higher rate of infection from PD

Table 2. Medications Prescribed to the Patient.

Medication	Drug class
Chlorhexidine gluconate disinfectant solution 0.05% (to CAPD exit site)	Antimicrobial
Clobetasol propionate cream 0.05%	Topical corticosteroid
Gentamicin sulfate cream 0.1%	Topical antibiotic (aminoglycoside)
Amikacin sulfate injection (parenteral 120 mg daily [intraperitoneal])	Aminoglycoside
Ceftazidime injection (parenteral 0.25 g qid [intraperitoneal])	Cephalosporin
CAPD Baxter Ultrabag (standard calcium) (2.5% dextrose 2.5 L × 3 bags per day)	Dialysis solution
CAPD Baxter Ultrabag (standard calcium) (7.5% icodextrin 2 L × 1 bag per day)	Dialysis solution
Metoprolol tablet (50 mg AM and 25 mg PM)	Beta-blocker
Losartan potassium tablet (oral 100 mg BD)	Angiotensin II receptor antagonist
Aspirin tablet (oral 80 mg daily)	Platelet aggregation inhibitor (salicylate)
Mircera prefilled syringe (methoxy polyethylene glycol-epoetin beta) (parenteral 100 mcg once per day [every 2 weeks])	Erythropoiesis stimulating agent
NaCl tablet (oral 1,800 mg BD)	Electrolyte replacement
$FeSO_4$ tablet (oral 300 mg daily)	Iron supplement
Calcitriol capsule (oral 0.25 mcg once per day [1 day per week])	Vitamin D analog
Simvastatin tablet (oral 5 mg nocte)	HMG-CoA reductase inhibitor
$CaCO_3$ chewable tablet (oral 1,000 mg daily with a meal)	Phosphate binder

Note. CAPD = continuous ambulatory peritoneal dialysis; qid = 4 times a day; BD = 2 times a day; HMG-CoA = 3-hydroxy-3-methylglutaryl coenzyme A.

within 12 months than those performing exchanges in areas with low exposure to environmental PM2.5 (Huang et al., 2014).

Ethical Approval

This case report was written retrospectively. No interventional protocol was administered to the patient concerned. Ethical approval from the author's affiliated institution was not required under the condition that confidentiality and anonymity of the patient were maintained in the final report and analysis. The patient provided written consent for the publication of his data.

Management and Outcome. There were three prioritized health problems in the present case: peritonitis and the exit-site infection, imbalanced nutrition (insufficient intake of nutrients required to meet the increased metabolic demands due to CAPD-associated peritonitis), and psychosocial concerns (workplace hygiene and inability to change jobs).

Nursing Management Strategies

Peritonitis and Exit-Site Infection. For immediate nursing management of the present case, the PD effluent was drained by the dialysis nurse after a dwell time of ~2 h and carefully inspected before laboratory tests were performed (cell counts, differential, gram stain, and cultures). Peritoneal lavage was then performed as prescribed by the physician, with three rapid exchanges of PD fluid bags to remove inflammatory cells and microorganisms from the peritoneal cavity and to provide symptomatic relief (Ballinger et al., 2014).

Empiric antibiotic therapy for PD-associated peritonitis was started as prescribed by the physician as soon as a cloudy effluent was noted (which can indicate peritonitis), without waiting for cell count and culture results from the laboratory. Table 2 shows a list of prescribed medications administered to the patient. Intraperitoneal administration of antibiotics is preferred over intravenous (IV) or per os routes to reduce the chances of treatment failure unless there is clinical evidence of systemic sepsis, in which case IV antibiotics are administered (Ballinger et al., 2014). An effluent cell analysis with a WBC > 100/μL (3,157/μL in the present case) with at least 50% PMN cells (97% in the present case) indicated that peritonitis was the most probable cause of the cloudy effluent. The dialysis nurse recommended that heparin was also indicated in the present case; with prescription, the addition of heparin at a dose of 500 IU in every 1 L of dialysate may assist in preventing catheter occlusion by inhibiting fibrin formation (Li et al., 2016).

For the exit-site infection, the initial nursing management involved the collection of a swab by the dialysis nurse for culture and sensitivity tests. The swab was taken at the first instance of exit-site inspection on admission. An appropriate antimicrobial therapy was then administered as prescribed. Antimicrobial therapy should cover both Gram-negative and Gram-positive bacteria (including *Staphylococcus aureus* which tends to cause relatively poor clinical outcomes such as the need for PD-catheter removal) (Li et al., 2016; Szeto et al., 2017). Because this patient had a history of *P. aeruginosa* infection, an antibiotic covering this microorganism was recommended by the dialysis nurse. In the present case, 0.1% gentamicin cream was prescribed by the physician, as purulence, tenderness, and edema were absent at the exit site. Once culture results were available, therapy

was modified based on the specific sensitivity patterns. In the present case, since gentamicin cream was effective against *P. aeruginosa*, it was continued as the drug of choice as recommended by the dialysis nurse.

The frequency of exit-site care with 0.5% chlorhexidine gluconate also needed to be increased (Wang et al., 2017). The clinical response was reviewed by the dialysis nurse after the initiation of antibiotic treatment, and clinical improvement was expected during the first 72 h. Once the culture and sensitivity results were known, the antibiotic therapy was appropriately adjusted by the physician, and continuous treatment was provided by the dialysis nurse. In the present case, the bacterial culture of the PD effluent revealed *Streptococcus mitis* that was sensitive to penicillin G.

Discussion

Since the patient admitted that he did not turn off the fan or close the doors and windows during CAPD bag exchange due to the hot weather, his knowledge of peritonitis, bag exchange techniques, and exit-site care was reviewed by the dialysis nurse. His hygiene status, living and working conditions, and self-care ability were also reassessed. Regarding environmental management in the course of exchanges, the National Kidney Foundation (NKF) has produced a resource booklet to guide patients to minimize the risk of CAPD-associated peritonitis (https://www.kidney.org/sites/default/files/docs/peritonealdialysis.pdf). To identify the potential infection causes, the dialysis nurse also asked about any recent history of endoscopic procedures and the presence of either constipation or diarrhea (Li et al., 2010). Retraining by dialysis nurses is recommended for patients following hospitalization, peritonitis, catheter infection, or change in vision (such as presbyopia), and as routine reinforcement with a minimum frequency of once per year (Zhang et al., 2016). The Nursing Liaison Committee of the International Society for PD (ISPD) reviewed PD training programs globally to develop a syllabus for training in this area (Figueiredo et al., 2016). The ISPD states (Bernardini et al., 2006) that patients often forget what they have been taught in a short time. During retraining, the dialysis nurse has an opportunity to assess whether or not the patient has adhered to clinical protocols and is performing all procedure steps correctly. The nurse may also assess changes, if any, in the patient's capacity to carry out procedures and understand PD concepts. Such assessments are vital for preventing peritonitis and other complications. Retraining presents opportunities to analyze the fundamental causes of problems to prevent them from recurring.

Imbalanced Nutrition

The patient reported poor appetite, probably due to abdominal distention and epigastric fullness, sometimes accompanied by nausea. Because of his poor appetite, he rarely consumed proteins, even though he was aware of the benefits of increased protein intake to compensate for losses via the dialysate. The patient had diarrhea, beginning on the day before admission, but it resolved shortly after admission. Weight change was assessed by a dialysis nurse by reviewing the patient's weight during the past 6 months. His weight decreased from 61.9 to 57.8 kg, a 6.6% weight loss over 6 months. His body mass index declined from 20.6 to 19.3 kg/m^2. The Subjective Global Assessment (SGA) scale was utilized by the dialysis nurse to evaluate his protein-energy nutritional status.[1] Higher scores generally indicate better dietary intake, better appetite, and the absence of gastrointestinal symptoms (Netherlands Cooperative Study on the Adequacy of Dialysis-2 Study Group, 2009). On admission, the patient's overall SGA rating was 5, representing a mild malnutrition level.

Timely referrals by dialysis nurses to a dietitian may facilitate the development of a dietary plan that can meet the patient's complex nutritional needs (Woodrow et al., 2017). An individualized dietary program should consider all aspects of nutritional management to achieve a fine balance to cope with the physiological stress of peritonitis among patients on CAPD. A dietary program was established in the present case, and the patient was advised by the dialysis nurse to keep a food diary for estimation and review of caloric, protein, and electrolyte intake. The food diary helped the dietitian identify nutritional deficits and select appropriate therapy within identified medical, cultural, and lifestyle restrictions.

Serum albumin is a clinically useful measure of protein status in patients on maintenance dialysis (Hao et al., 2019). It may fall modestly with a sustained decrease in dietary protein and energy intake and may rise with increased intake. In the present case, the serum albumin level showed a downward trend from 36 to 30 g/L during the previous 6 months. Patients on PD with a baseline serum albumin <30 g/L have a three-fold higher mortality risk (Mehrotra et al., 2011) and a greater risk of peritonitis (Wu et al., 2020). In the event of peritonitis, albumin loss may increase as much as 10-fold, due to the increased peritoneal permeability resulting from multiple inflammatory processes, and this condition may continue for several months after the infection has resolved (Gray-Byham et al., 2013). Dialysate protein losses may average 5–10 g daily; however, during episodes of peritonitis, this could increase markedly to 10–25 g daily (Kopple et al., 2012). Hence, the target daily protein intake for patients on PD should increase from 1.2 to >1.5 g/kg during episodes of peritonitis (Daugirdas et al., 2015).

To increase protein intake despite feelings of fullness, dialysis nurses advised the patient to consume protein-rich foods first and limit fluids during mealtimes. The patient was also advised to eat small frequent meals of high nutritional value with protein containing high essential amino

acid content, including egg whites, milk, and meat (Gray-Byham et al., 2013). The International Society of Renal Nutrition and Metabolism recommends that indications for prescription of nutritional supplements include poor appetite and/or poor oral intake, a serum albumin level <38 g/L, and unintentional weight loss >5% of the ideal body weight or end-dialysis weight over 3 months (Ikizler et al., 2013). If the aforementioned corrective approaches fail, Nutrineal (nonglucose-based PD solution) may be considered by the dialysis nurses and physicians. Patients may also be considered for enteral or parenteral supplementation if they are unable to sustain adequate intake of conventional foods. Eating and appetite may also be promoted when the peritoneal fluid is being drained and the feeling of fullness is reduced.

The delivery of a dialysis dose less than that required can adversely affect a patient's appetite, nutrient intake, and measures of nutrition (Nitta & Tsuchiya, 2016). To ensure the adequacy of dialysis, a satisfactory weekly Kt/V_{urea} of at least 2 for patients on PD, with a minimum weekly Kt/V_{urea} of 1.7, is the goal (Dombros et al., 2005). The provision of adequate dialysis could mitigate uremia-associated anorexia and might improve hypercatabolism. If Kt/V_{urea} is borderline (1.78 in the present case), consideration should be given to increasing the PD dose or the number of CAPD bag exchanges and assessing prescription adherence (National Kidney Foundation, 2006; Szeto et al., 2019). However, in the present case, the dialysis nurse opined that a further increase in the dose/number of CAPD bag exchanges could have compromised the patient's quality of life and led to a transfer to hemodialysis. The nephrology team was contacted to determine whether a switch to a different method of PD would be required. The use of APD with larger dwell volumes and longer nocturnal sessions (especially in combination with icodextrin), or the addition of a day exchange, could improve the technique and prolong survival, with better adequacy of dialysis (El-Reshaid et al., 2016; Wang et al., 2016). In the present case, the PET, as recommended by the dialysis nurses, classified the patient as an average transporter, with a D/P creatinine of 0.791 and D/D0 glucose of 0.334 at 4 h. Therefore, both CAPD and APD were appropriate options.

Psychosocial Needs

In addition to physical discomfort over the course of long-term management, patients with kidney failure may experience psychosocial distress (Dąbrowska-Bender et al., 2018; Griva et al., 2014). In the present case, such distress was associated with perceived financial and employment challenges. The average annual maintenance cost of CAPD varies among countries (Wearne et al., 2017). For example, the cost is US$12,800 in Hong Kong (Yu et al., 2007). Patients who can sustain employment may be concerned with reduced household productivity and personal earnings

because of the adoption of a certain dialysis regimen, while socioeconomically disadvantaged patients may have limited means to fund the expenses incurred from PD (Walker et al., 2016).

Since the patient was able to retain his employment, a dialysis nurse decided to refine the home dialysis schedule to accommodate his work needs. With the requirement of maintaining dialysis adequacy in mind, his home dialysis was adjusted to minimize the need for CAPD bag exchanges at the workplace. Adjusted supply deliveries, clinic visits, and exchange timings also helped the patient to sustain employment while avoiding exchanges at work and adhering to the dialysis schedule (Jung et al., 2019). At the patient's request, a dialysis nurse also inspected the office environment where the PD exchange would take place and offered suggestions and support. The dialysis nurse continued to monitor whether the patient was able to adapt the dialysis regimen into his daily life, reviewing his ability to perform PD safely at his office and home.

Anticipating that the patient may fail to perform PD at work, the dialysis nurse also introduced APD and discussed the possibility of switching renal replacement modalities according to his needs and treatment responses. APD may represent a better option for patients who are frequently unable or unwilling to perform multiple daytime exchanges (Roumeliotis et al., 2020). Research undertaken in Hong Kong showed statistically significant variations in employment status for patients receiving APD and CAPD (Kwan et al., 2013). APD patients (62.2%) were more likely to have full-time employment than CAPD patients (15%) (Kwan et al., 2013). Another research showed that, if a patient had high levels of activities of daily living, they were more likely to select APD for their renal replacement therapy (Roumeliotis et al., 2020). End-stage renal disease (ESRD) patients who were not working had notably lower scores on the physical function and role emotional scales (of the The Short Form 36 Health Survey Questionnaire (SF-36) health survey) than those who were working, indicating that the needs of an occupation should be considered as part of the plan for long-term care in patients with ESRD (Blake et al., 2000).

Additionally, patients requiring assistance in performing dialysis are better served by APD than by CAPD (Cnossen et al., 2011). Connections and disconnections can be minimized to two, reducing the burden on both the patient and provider. The overall rate of peritonitis in patients receiving APD was found to be 64.1 patient months per episode, which was much better than the rate of CAPD-associated peritonitis (which was found to be 35.8 patient months per episode) (Ho et al., 2013). The reduced number of connections and disconnections to and from the abdominal PD catheter is thought to be crucial in terms of technique and survival (Bieber et al., 2014). Most of the connections in APD occur between two sterile surfaces; however, in CAPD, most

connections involve fine manual manipulation between a PD set and a reusable transfer line connected to the peritoneal catheter. Although APD is more expensive than CAPD, patients on the former modality enjoy significantly more time for work, family, and social activities than those on CAPD (Rabindranath et al., 2007).

It appears that APD treatments are useful in helping patients carry on with their daily lives, as most of the dialysis is undertaken during sleep. However, if this treatment is not correctly applied and does not have sufficient support from the dialysis nurses, the patient can be frequently woken by alarms from the machinery, which can change their sleep patterns, making patients frustrated and exhausted. Research has examined the quality of life for those experiencing the two PD forms (Bieber et al., 2014). However, small-scale prospective research demonstrated that, while individuals on APD found that they enjoyed greater time for employment, families, and socializing, they did not enjoy disturbed sleep, as compared to patients on CAPD (Bro et al., 1999). Cross-sectional survey research found that patients on APD had better mental health and less anxiety than those on CAPD (de Wit et al., 2001). Despite these two studies, there is a scarcity of research showing that there are significant differences in the quality of life between patients on APD and those on CAPD; therefore, it is too early to use quality of life as a selection criterion for the type of treatment in this area.

Following the administration of intraperitoneal antibiotics (amikacin sulfate 120 mg/day and ceftazidime 0.25 g four times/day), the patient was free of peritonitis symptoms in 7 days after admission, as evidenced by the absence of fever, chills, rigors, and abdominal tenderness on palpation. After dietary counseling, the patient verbalized his understanding of the need to increase protein consumption in his diet, and he agreed to keep a food diary, recording his daily intake, to enable health care professionals to monitor his diet and nutritional status. Additional outpatient appointments were made with dietitians and dialysis nurses for continual dietary management. At the time of discharge, the patient expressed a strong interest in pursuing APD and was referred to the nephrology team to evaluate the possibility of switching to this modality. The patient thanked the dialysis nurses for the individualized PD protocol tailored to his personal lifestyle and schedule. He appreciated the learning gained after the provided education on self-care techniques. Additionally, the continuous nutritional management has provided him extended support to prevent recurrence and improve his overall health.

A limitation of this case report is its retrospective design. Since no experimental component was involved, this may lead to decreased generalizability of our findings. However, this case-report design was chosen because it can provide empirically rich, context-specific, holistic accounts about how dialysis nurses can apply evidence-based practice toward better health outcomes for patients undergoing PD.

Conclusion

This case report promotes evidence-based practice by demonstrating the translation of updated research knowledge into practice in a real-life clinical case. Multiple strategies, with supporting evidence, were adopted in response to the nursing concerns arising from the incidence of CAPD-associated peritonitis in a 62-year-old male patient. Considering that the PD prevalence rate in Hong Kong is the highest worldwide, the practical experience presented in this case report can act as a valuable reference for other clinicians, dialysis nurses, and nursing practitioners worldwide.

Of the many factors that contribute to the success of the PD-first policy in Hong Kong, the pivotal roles of dialysis nurses in preventing and managing CAPD-associated peritonitis have been repeatedly highlighted in the literature. Nevertheless, a limited number of in-depth case reports are available to illustrate the intricate processes and considerations in the nursing management of CAPD-associated peritonitis of a patient with amyloidosis in a hospital setting.

Currently, in Hong Kong, there is no registration framework for nurse practitioners in renal nursing. However, dialysis nurses and other specialist nurses should be educated and accredited, enabling them to work cooperatively with others as well as independently. In terms of providing care to PD patients, specialist nurses should be able to undertake accurate, continuous, and systematic health assessments. The problems identified by the nurse should be raised with colleagues, the patients, and their families, and steps to address the problems should be incorporated into care plans, which should be implemented in a manner that is appropriate to achieve the specified nursing care outcomes. To promote patients' rehabilitation, specialist nurses should be willing to work with other health care professionals and incorporate current research findings into their practice. This latter point is essential for Hong Kong's renal nurses as, to consistently provide patients with the highest standards of care, they need to keep their knowledge and skills up-to-date.

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Notes

1. Nutritional state can be evaluated using the SGA instrument (Dai et al., 2017). The tool is made up of two broad components: medical history and physical examination. The first of these

components considers diet, gastrointestinal symptoms, functional capacity, and the presence of disease and its effect on nutrition. The second component seeks out evidence on fat and muscle wasting and nutrition-associated alterations in fluid balance (Steiber et al., 2004). Results from the CANUSA study revealed that, in CAPD patients, a 1 unit reduction in the SGA score corresponds to a 25% increase in mortality (Canada-USA (CANUSA) Peritoneal Dialysis Study Group, 1996). A recent research also supported the CANUSA study (Vogt & Caramori, 2016). To assess the nutritional state of adult dialysis patients, the NKF kidney disease/dialysis outcomes and quality initiative (K/DOQI) recommends the use of SGA (Ikizler et al., 2020).

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