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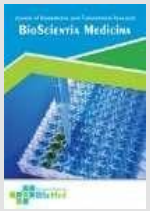

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Prolonged Hospital Stays in Continuous Ambulatory Peritoneal Dialysis (CAPD) Patients: The Role of Comorbid Conditions

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A B S T R A C T

Background: Continuous ambulatory peritoneal dialysis (CAPD) is a widely used treatment for end-stage renal disease (ESRD), but it is associated with frequent hospitalizations that can significantly impact patients' quality of life and increase healthcare costs. This study aimed to investigate the influence of comorbid conditions on the length of hospital stay (LOS) in CAPD patients. **Methods:** A retrospective cohort study was conducted on CAPD patients admitted to Dr. Kariadi General Hospital Semarang between January 1st, 2023, and December 31st, 2023. Data on demographics, comorbidities, and LOS were extracted from medical records. The Charlson Comorbidity Index (CCI) was used to assess comorbidity burden. Multivariable linear regression analysis was performed to identify predictors of prolonged LOS, defined as exceeding the median LOS. **Results:** The study included 52 CAPD patients with a median LOS of 18 days (range: 1-72 days). Patients with comorbidities had a significantly longer LOS compared to those without comorbidities (20.25 ± 12.88 days vs. 12.50 ± 3.63 days, p = 0.045). The presence of comorbidities was significantly associated with prolonged LOS (odds ratio [OR] 2.87, 95% confidence interval [CI] 1.15-7.16, p = 0.023), as were older age (OR 1.05, 95% CI 1.01-1.09, p = 0.012) and peritonitis as the primary reason for hospitalization (OR 3.54, 95% CI 1.38-9.08, p = 0.008). **Conclusion:** Comorbid conditions are significant contributors to prolonged hospital stays in CAPD patients. These findings underscore the importance of effectively managing comorbidities in this population to optimize healthcare resource utilization and improve patient outcomes.

1. Introduction

Chronic kidney disease (CKD) is a global health issue that is characterized by the gradual loss of kidney function over time. It affects millions of people worldwide, posing a significant burden on healthcare systems and impacting patients' quality of life. When kidney function deteriorates to the point where it can no longer sustain life, it is termed end-stage renal disease (ESRD). ESRD is a severe condition that necessitates renal replacement therapy, either through dialysis or kidney transplantation, for survival. Continuous ambulatory peritoneal dialysis (CAPD) is a form of peritoneal dialysis (PD) that has emerged as a viable alternative to hemodialysis for patients with ESRD. It offers several advantages, including greater flexibility, patient autonomy, and the ability to perform dialysis exchanges at home or in other convenient settings. This eliminates the need for frequent trips to a dialysis center, allowing patients to maintain a more active lifestyle and reducing the disruption to their daily routines. Despite the benefits of CAPD, patients undergoing this treatment modality often experience complications and comorbidities that can lead to hospitalizations. These hospitalizations

can significantly impact patients' quality of life, disrupt their dialysis regimen, and increase healthcare costs. Common complications associated with CAPD include peritonitis, catheter-related infections, and fluid imbalances. Additionally, ESRD patients often have multiple comorbid conditions, such as diabetes, hypertension, cardiovascular disease, and malnutrition, which can further complicate their clinical course and increase the likelihood of hospitalization.[1-3]

Comorbid conditions are highly prevalent in patients with ESRD, and their presence can significantly influence the outcomes of CAPD treatment. These comorbidities can interact with ESRD and its treatment, leading to a complex interplay of factors that can affect patients' overall health and well-being. Some of the common comorbidities encountered in CAPD patients include; Diabetes: Diabetes is a leading cause of ESRD, and its presence in CAPD patients can lead to challenges in managing blood glucose levels due to the glucose-based dialysis solutions used in CAPD. Additionally, diabetes can increase the risk of cardiovascular disease, infections, and other complications, which can further complicate CAPD management and increase the likelihood of hospitalization; Hypertension: Hypertension is another common comorbidity in CAPD patients, and it can contribute to cardiovascular disease, stroke, and other complications. Managing hypertension in CAPD patients can be challenging due to fluid shifts and electrolyte imbalances associated with dialysis; Cardiovascular Disease: Cardiovascular disease is a major cause of morbidity and mortality in ESRD patients, including those undergoing CAPD. The presence of cardiovascular disease can increase the risk of complications such as heart attacks, strokes, and heart failure, which can lead to hospitalization and adverse outcomes; Infections: CAPD patients are at an increased risk of infections, particularly peritonitis, which is an infection of the peritoneum. Peritonitis is a serious complication that can lead to hospitalization, catheter removal, and even death. Other infections, such as pneumonia, urinary tract infections, and skin infections, can also occur in CAPD patients and contribute to hospitalizations; Malnutrition: Malnutrition is a common problem in ESRD patients, and it can be exacerbated by the dietary restrictions and metabolic changes associated with CAPD. Malnutrition can lead to weakness, fatigue, impaired immune function, and an increased risk of infections, all of which can contribute to hospitalizations.[4-6]

LOS is a critical indicator of healthcare resource utilization and patient outcomes. It represents the duration of a patient's hospital stay and can be influenced by various factors, including the severity of illness, complications, and the need for specialized care. In the context of CAPD patients, LOS is an important metric for assessing the effectiveness of treatment and identifying areas for improvement in care delivery. Prolonged hospital stays in CAPD patients can have several negative consequences. First, they can lead to increased healthcare costs due to the extended use of hospital resources, such as bed days, medications, and diagnostic tests. Second, prolonged hospitalizations can increase the risk of hospital-acquired infections, which can further complicate patients' clinical course and lead to adverse outcomes. Third, extended hospital stays can disrupt patients' dialysis regimens, potentially leading to fluid imbalances, electrolyte disturbances, and other complications. Finally, prolonged hospitalizations can cause psychological distress and anxiety for patients, affecting their overall quality of life.[7,8]

Several factors can contribute to prolonged LOS in CAPD patients. These factors can be broadly categorized into patient-related factors, disease-related factors, and healthcare system-related factors; Patient-related factors include age, gender, socioeconomic status, and the presence of comorbidities. Older age is often associated with a decline in functional status and an increased prevalence of comorbidities, both of which can contribute to longer hospitalizations. Comorbidities,

as discussed earlier, can complicate CAPD management and increase the risk of complications, leading to more complex hospitalizations and extended LOS; Disease-related factors include the primary reason for hospitalization, the severity of illness, and the presence of complications. Peritonitis, a serious complication of CAPD, is a common reason for hospitalization and can lead to prolonged LOS. Other complications, such as catheter-related infections, fluid imbalances, and cardiovascular events, can also contribute to extended hospital stays; Healthcare system-related factors include the availability of specialized care, the efficiency of hospital processes, and the quality of care delivery. Delays in diagnosis, treatment, or discharge planning can all contribute to prolonged LOS. Additionally, the availability of specialized services, such as intensive care units (ICUs) and infectious disease consultations, can influence the duration of hospitalization.[9,10] This study aimed to investigate the impact of comorbid conditions on the LOS of CAPD patients admitted to Dr. Kariadi General Hospital Semarang.

2. Methods

This retrospective cohort study was conducted at Dr. Kariadi General Hospital Semarang, a tertiary referral hospital in Central Java, Indonesia. The hospital serves a diverse population and provides comprehensive healthcare services, including a dedicated nephrology and dialysis unit. The study period encompassed all CAPD patient admissions between January 1st, 2023, and December 31st, 2023. This timeframe was chosen to capture a substantial number of CAPD patients and provide a representative sample of the hospital's CAPD population. The study population consisted of all adult patients (18 years or older) with a confirmed diagnosis of ESRD who were receiving CAPD treatment at the time of admission to Dr. Kariadi General Hospital. ESRD was diagnosed based on established clinical criteria, including estimated glomerular filtration rate (eGFR) and serum creatinine levels. CAPD treatment involves the use of a peritoneal catheter for instilling and draining dialysis fluid multiple times a day. Patients were excluded from the study if they had incomplete medical records, which could compromise the accuracy and reliability of data analysis. Additionally, patients receiving other forms of dialysis, such as hemodialysis, were excluded to maintain the homogeneity of the study population and focus specifically on the impact of comorbidities in CAPD patients.

Data were collected through a meticulous review of patients' electronic medical records (EMRs). EMRs provide a comprehensive and readily accessible source of patient information, including demographics, medical history, laboratory results, imaging reports, and treatment details. A standardized data collection form was developed to ensure consistency and accuracy in data extraction. The form was pilot-tested on a small sample of EMRs to identify and address any potential ambiguities or inconsistencies. The following data were systematically extracted from each patient's EMR; Demographics: Age, gender, ethnicity, and educational level were recorded to characterize the study population and assess potential demographic influences on LOS; Comorbidities: A comprehensive assessment of comorbidities was performed, including diabetes, hypertension, cardiovascular disease, cerebrovascular disease, chronic lung disease, cancer, liver disease, and human immunodeficiency virus (HIV) infection. These comorbidities were identified based on documented diagnoses, medication lists, and relevant laboratory or imaging findings; CAPD-related information: The duration of CAPD treatment and history of peritonitis episodes were documented to assess their potential impact on LOS; Hospitalization details: The primary reason for hospitalization, LOS, and in-hospital mortality were recorded to characterize the hospitalization episodes and their outcomes.

The Charlson Comorbidity Index (CCI) was employed to quantify the burden of comorbidities in the study population. The CCI is a widely used and validated scoring system that assigns weights to different comorbid conditions based on their

association with mortality risk. The CCI score ranges from 0 to 37, with higher scores indicating a greater comorbidity burden. The CCI was chosen for its simplicity, ease of use, and established validity in predicting outcomes in various patient populations, including ESRD patients.

Descriptive statistics were used to summarize patient characteristics, comorbidity profiles, CAPD-related information, and hospitalization details. Continuous variables, such as age and LOS, were expressed as mean ± standard deviation (SD) or median (range), depending on their distribution. Categorical variables, such as gender and comorbidities, were presented as frequencies and percentages. The normality of data distribution was assessed using the Shapiro-Wilk test. For continuous variables that were normally distributed, the Student's t-test was used to compare means between two groups, while one-way analysis of variance (ANOVA) was used for comparing means among three or more groups. For non-normally distributed continuous variables, the Mann-Whitney U test or Kruskal-Wallis test was used for two-group or multiple-group comparisons, respectively. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. To identify predictors of prolonged LOS, defined as exceeding the median LOS, multivariable logistic regression analysis was performed. Variables that were significant in univariate analysis ($p < 0.10$) were included in the multivariable model. The following variables were considered as potential predictors: age, gender, CCI score, duration of CAPD treatment, history of peritonitis, and the primary reason for hospitalization. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using SPSS software version 26 (IBM Corp., Armonk, NY, USA).

3. Results

Table 1 presents the baseline characteristics of the 52 CAPD patients included in the study. The average age of the patients was 54.2 years, with a standard deviation of 13.8 years. The majority of the patients were male (57.7%). The median CCI score was 2, with an interquartile range (IQR) of 1-3, indicating that most patients had a low to moderate burden of comorbidities. The most common comorbidities among the patients were hypertension (73.1%), diabetes mellitus (53.8%), and cardiovascular disease (34.6%). The median dialysis vintage was 24 months, with an IQR of 12-48 months, suggesting that most patients had been receiving dialysis treatment for a significant duration. During the study period, 42.3% of the patients experienced peritonitis, 23.1% had catheter-related complications, and 15.4% had cardiovascular events. These complications are commonly associated with CAPD and can contribute to prolonged hospital stays.

Table 1. Baseline characteristics.

Characteristic	Value
Age (years)	54.2 ± 13.8
Male	57.70%
CCI score (median, IQR)	2 (1-3)
Hypertension	73.10%
Diabetes mellitus	53.80%
Cardiovascular disease	34.60%
Dialysis vintage (months, median, IQR)	24 (12-48)
Peritonitis	42.30%
Catheter-related complications	23.10%
Cardiovascular events	15.40%

Table 2 displays the length of hospital stay (LOS) for patients undergoing continuous ambulatory peritoneal dialysis (CAPD), categorized by the presence or absence of comorbidities. The median LOS for all patients was 18 days, with an interquartile range (IQR) of 10-28 days. Patients with comorbidities had a significantly longer LOS (20.25 ± 12.88 days) compared to those without comorbidities (12.50 ± 3.63 days), as evidenced by a p-value of 0.045. This difference highlights the impact of comorbidities on prolonging hospital stays in CAPD patients.

Table 2. Length of hospital stay.

Characteristic	Value
Median (IQR)	18 (10-28)
With comorbidities (mean ± SD)	20.25 ± 12.88
Without comorbidities (mean ± SD)	12.50 ± 3.63
p-value	0.045

Table 3 shows the results of a multivariable analysis that was done to find out which independent factors predicted a prolonged length of stay (LOS), which was defined as any stay longer than the median LOS, in CAPD patients. Even after adjusting for other factors in the model, having comorbidities was strongly linked to a 2.87 times higher chance of having a longer hospital stay. This backs up the original idea and shows how much comorbidities can affect how long someone stays in the hospital. For every year older a patient was, their chance of having a longer LOS went up by 5%. This shows that older CAPD patients tend to stay in the hospital longer, probably because their bodies don't bounce back as well as younger patients and because they often have more health problems. If a patient was hospitalized mainly because of peritonitis, they were much more likely to have a longer LOS. In fact, they had 3.54 times higher odds of a longer stay than those admitted for other reasons. This shows how serious peritonitis is as a complication of CAPD.

Table 3. Predictors of prolonged length of stay.

Predictor	Odds Ratio (95% CI)	p-value
Comorbidities	2.87 (1.15-7.16)	0.023
Older age	1.05 (1.01-1.09)	0.012
Peritonitis	3.54 (1.38-9.08)	0.008

4. Discussion

Comorbid conditions exert a multifaceted influence on the health and well-being of patients undergoing continuous ambulatory peritoneal dialysis (CAPD), often leading to more complex hospitalizations and extended lengths of stay (LOS). Understanding the intricate interplay between comorbidities and CAPD treatment is crucial for optimizing patient care and improving outcomes. Fluid management is a cornerstone of continuous ambulatory peritoneal dialysis (CAPD) therapy, as it directly influences patients' volume status, blood pressure control, and overall well-being. The delicate balance of fluid removal and retention in CAPD can be significantly complicated by the presence of comorbidities, necessitating meticulous monitoring and adjustments to the dialysis prescription. CAPD involves the continuous presence of dialysis fluid in the peritoneal

cavity, which facilitates the removal of waste products and excess fluid from the blood. The peritoneum, a semi-permeable membrane lining the abdominal cavity, acts as a natural filter, allowing for the exchange of solutes and water between the blood and dialysis fluid. The osmotic gradient created by the dialysis fluid, typically containing glucose, draws excess fluid from the bloodstream into the peritoneal cavity, where it is then drained and replaced with fresh fluid. Maintaining optimal fluid balance in CAPD patients requires a careful assessment of their fluid status, considering factors such as body weight, blood pressure, and clinical signs of fluid overload or dehydration. Fluid overload can lead to hypertension, edema (swelling), and shortness of breath, while dehydration can cause hypotension (low blood pressure), dizziness, and fatigue. Healthcare providers must closely monitor these parameters and adjust the dialysis prescription accordingly to ensure that patients remain euvolemic (having the appropriate amount of fluid in the body). Comorbidities, or co-existing medical conditions, can disrupt the delicate balance of fluid management in CAPD patients, making it more challenging to achieve and maintain euvolemia. Conditions such as heart failure and diabetes are particularly notorious for their impact on fluid balance. Heart failure, characterized by the heart's inability to pump blood effectively, can lead to fluid retention due to decreased cardiac output and activation of neurohormonal systems that promote fluid conservation. In CAPD patients with heart failure, the kidneys' reduced ability to excrete excess fluid further exacerbates the fluid overload. This can lead to a vicious cycle of fluid retention, worsening heart failure symptoms, and increased strain on the cardiovascular system. Diabetes, a metabolic disorder affecting blood sugar regulation, can also disrupt fluid balance in CAPD patients. Hyperglycemia (high blood sugar) can lead to increased thirst and urination, resulting in fluid loss and dehydration. Additionally, diabetes can cause kidney damage (diabetic nephropathy), further impairing the kidneys' ability to regulate fluid balance. Other comorbidities, such as liver disease, malnutrition, and certain medications, can also influence fluid balance in CAPD patients. Liver disease can impair the production of albumin, a protein that helps maintain fluid within the blood vessels, leading to fluid leakage into the tissues. Malnutrition can cause hypoalbuminemia (low albumin levels), further contributing to fluid imbalances. Certain medications, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids, can also affect fluid balance by altering kidney function or promoting fluid retention. In the presence of comorbidities, achieving and maintaining optimal fluid balance in CAPD patients becomes a delicate balancing act. Healthcare providers must carefully assess patients' fluid status, considering factors such as weight changes, blood pressure readings, and clinical signs of fluid overload or dehydration. Adjustments to the dialysis prescription, including changes in the composition and volume of dialysis fluid, may be necessary to address fluid imbalances. The composition of dialysis fluid can be modified to alter its osmotic gradient, thereby influencing the amount of fluid removed from the blood. Increasing the glucose concentration in the dialysis fluid can enhance fluid removal, while decreasing it can reduce fluid removal. The volume of dialysis fluid used in each exchange can also be adjusted to fine-tune fluid balance. The complexities of fluid management in CAPD patients with comorbidities often necessitate a longer hospital stay to ensure that patients' fluid status is stable before discharge. During hospitalization, healthcare providers can closely monitor patients' fluid balance, make timely adjustments to the dialysis prescription, and provide supportive care as needed. This allows for a more controlled environment to optimize fluid management and minimize the risk of complications associated with fluid imbalances. Continuous ambulatory peritoneal dialysis (CAPD) is a valuable renal replacement therapy that offers patients with end-stage renal disease (ESRD) greater flexibility and independence compared to traditional hemodialysis. However, CAPD is not without its challenges, and one

of the most significant concerns is the increased risk of infections, particularly peritonitis. This risk is further amplified in the presence of comorbidities, which can compromise immune function and complicate the management of infections. Peritonitis, an infection of the peritoneum (the lining of the abdominal cavity), is a serious complication that can lead to significant morbidity and mortality in CAPD patients. The presence of a peritoneal catheter, a tube surgically inserted into the abdomen to facilitate dialysis, provides a potential entry point for bacteria into the peritoneal cavity. Even with meticulous catheter care and strict adherence to aseptic techniques, the risk of peritonitis remains a constant concern. Comorbidities, or co-existing medical conditions, can significantly increase the susceptibility of CAPD patients to infections, including peritonitis. Many comorbidities, such as diabetes, cardiovascular disease, and malnutrition, can impair immune function, making it more difficult for the body to fight off invading pathogens. Diabetes, a metabolic disorder characterized by elevated blood sugar levels, can damage blood vessels and nerves, impairing circulation and reducing the delivery of immune cells to sites of infection. Cardiovascular disease, which affects the heart and blood vessels, can also compromise blood flow and hinder the immune response. Malnutrition, often prevalent in ESRD patients, can weaken the immune system by depriving the body of essential nutrients needed for proper immune function. Infections in CAPD patients, particularly peritonitis, are often more challenging to treat compared to those in the general population. The presence of a peritoneal catheter can make it difficult to eradicate the infection completely, as bacteria can adhere to the catheter surface and form biofilms, which are communities of bacteria encased in a protective matrix that makes them resistant to antibiotics. Moreover, the use of immunosuppressive medications to prevent rejection in kidney transplant recipients can further compromise immune function and hinder the body's ability to fight off infections. This can lead to prolonged antibiotic courses and a greater need for hospitalization to manage the infection effectively. The treatment of infections in CAPD patients often involves prolonged courses of antibiotics, sometimes requiring hospitalization to administer intravenous antibiotics and provide supportive care. In severe cases, such as peritonitis that does not respond to antibiotics, surgical intervention may be necessary to remove the infected peritoneal catheter. Hospitalization allows for close monitoring of the patient's condition, including vital signs, laboratory values, and clinical signs of improvement or deterioration. It also enables healthcare providers to administer intravenous antibiotics and provide other supportive measures, such as fluid management and pain control. In some cases, hospitalization may be necessary to perform surgical procedures, such as catheter removal or drainage of infected fluid collections. The increased risk of infections and the complexities associated with their treatment contribute to prolonged hospital stays in CAPD patients with comorbidities. Infections can lead to a cascade of complications, such as sepsis (a life-threatening condition caused by the body's overwhelming response to an infection), fluid imbalances, and electrolyte disturbances, all of which can necessitate extended hospital stays. Comorbidities can further complicate the management of infections and prolong hospitalizations. For instance, patients with diabetes may have impaired wound healing, increasing the risk of complications from surgical procedures. Patients with cardiovascular disease may be more susceptible to fluid overload and electrolyte imbalances, requiring careful monitoring and adjustments to their dialysis prescription. Continuous ambulatory peritoneal dialysis (CAPD) patients often present with a complex clinical picture due to the presence of multiple comorbidities. These comorbidities interact with each other and with end-stage renal disease (ESRD), creating a complex web of interconnected health issues that require specialized care. The intricate management of these comorbidities can contribute to extended hospital stays in CAPD patients.

Comorbidities, or co-existing medical conditions, are highly prevalent in CAPD patients. Common comorbidities include diabetes, hypertension, cardiovascular disease, and malnutrition. These conditions can interact with each other and with ESRD, leading to a complex interplay of factors that can affect patients' overall health and well-being. For instance, a patient with diabetes and cardiovascular disease may have a higher risk of developing complications such as foot ulcers or cardiovascular events, which can necessitate hospitalization and a longer recovery period. Diabetes can damage blood vessels and nerves, impairing circulation and increasing the risk of foot ulcers. Cardiovascular disease can further compromise blood flow, exacerbating the risk of foot ulcers and other complications. The presence of multiple comorbidities can also make it more challenging to manage medications and dialysis prescriptions, as drug interactions and side effects must be carefully considered. For example, certain medications used to treat hypertension can worsen kidney function, while some antibiotics can interact with medications used to manage diabetes. In these complex cases, a multidisciplinary approach to care is essential. Nephrologists, cardiologists, endocrinologists, and other specialists may need to collaborate to develop and implement a comprehensive treatment plan that addresses the patient's unique needs. This may involve close monitoring of various parameters, such as blood pressure, blood sugar levels, and electrolyte balance, as well as adjustments to medications and dialysis prescriptions. Specialized care may also involve addressing the specific needs of individual comorbidities. For example, patients with diabetes may require education on blood sugar monitoring and insulin management, while patients with cardiovascular disease may need guidance on lifestyle modifications and medication adherence. The need for specialized care and the intricate management of multiple comorbidities can contribute to extended hospital stays in CAPD patients. Hospitalization allows for close monitoring of the patient's condition, including vital signs, laboratory values, and clinical signs of improvement or deterioration. It also enables healthcare providers to administer medications, provide dialysis treatments, and perform other interventions as needed. In some cases, hospitalization may be necessary to perform diagnostic tests or procedures, such as imaging studies or biopsies. Hospitalization may also be required to manage complications, such as infections or fluid imbalances.[11-13]

In addition to the complex interplay of comorbidities, our study identified older age and peritonitis as independent predictors of prolonged length of stay (LOS) in continuous ambulatory peritoneal dialysis (CAPD) patients. These findings underscore the importance of considering these factors when assessing and managing CAPD patients, particularly those with multiple comorbidities. Older age is a significant factor influencing the health and well-being of patients undergoing continuous ambulatory peritoneal dialysis (CAPD). As individuals age, they experience a natural decline in physiological reserve, which refers to the body's ability to withstand stress and recover from illness. This decline can manifest in various ways, making older CAPD patients more susceptible to complications, slower to recover from illnesses, and more likely to require longer hospital stays. One of the most prominent manifestations of physiological decline in older adults is decreased kidney function. The kidneys play a vital role in filtering waste products from the blood and maintaining fluid and electrolyte balance. As people age, the kidneys naturally lose some of their filtering capacity, making them less efficient at removing toxins and regulating fluid balance. This decline in kidney function can exacerbate the challenges of managing ESRD and increase the risk of complications in older CAPD patients. The immune system, responsible for defending the body against infections and other harmful agents, also undergoes age-related changes. Older adults tend to have a weaker immune response, making them more susceptible to infections, including peritonitis, a

serious complication of CAPD. The reduced ability to fight off infections can lead to more severe illnesses, slower recovery times, and a greater need for hospitalization in older CAPD patients. Wound healing is a complex process that involves various cellular and molecular mechanisms. As people age, these mechanisms may become less efficient, leading to impaired wound healing. This can be particularly problematic for CAPD patients, who require a peritoneal catheter, a tube surgically inserted into the abdomen to facilitate dialysis. Impaired wound healing can increase the risk of complications at the catheter insertion site, such as infections or leaks, which can necessitate longer hospital stays. In addition to the direct effects of physiological decline, older age is often accompanied by an increased prevalence of comorbidities, or co-existing medical conditions. These comorbidities can further complicate the clinical picture and contribute to prolonged hospitalizations in older CAPD patients. For instance, older CAPD patients may have a higher likelihood of having cardiovascular disease, diabetes, or other chronic conditions that can interact with ESRD and its treatment. Cardiovascular disease can affect blood flow to vital organs, including the kidneys, further compromising kidney function and increasing the risk of complications. Diabetes can damage blood vessels and nerves, impairing circulation and increasing the risk of infections and other complications. The combination of physiological decline and comorbidities can create a particularly challenging clinical scenario for older CAPD patients. The decreased physiological reserve can make them more vulnerable to the effects of comorbidities, while the presence of multiple comorbidities can further exacerbate the challenges of managing ESRD and its treatment. This complex interplay of factors can lead to more frequent and prolonged hospitalizations in older CAPD patients. They may require longer hospital stays to stabilize their condition, manage complications, and recover from illnesses. The increased risk of complications and the need for specialized care can also contribute to extended hospitalizations. The understanding of the impact of older age and physiological decline on CAPD patients has important implications for clinical practice. Healthcare providers should be aware of the increased risk of complications and the need for individualized care in this population. Close monitoring of older CAPD patients is essential to detect early signs of complications and intervene promptly. Regular assessments of kidney function, immune response, and wound healing can help identify potential problems and guide treatment decisions. Comprehensive management of comorbidities is also crucial to minimize their impact on overall health and reduce the risk of complications. Continuous ambulatory peritoneal dialysis (CAPD) has revolutionized the treatment of end-stage renal disease (ESRD), offering patients a more flexible and independent alternative to hemodialysis. However, CAPD is not without its challenges, and one of the most serious complications is peritonitis, an infection of the peritoneum (the lining of the abdominal cavity). Peritonitis can lead to sepsis, a life-threatening condition characterized by the body's overwhelming response to an infection. The presence of a peritoneal catheter, a tube surgically inserted into the abdomen to facilitate dialysis, is a major risk factor for peritonitis. The catheter provides a potential entry point for bacteria into the peritoneal cavity. Even with meticulous catheter care and strict adherence to aseptic techniques, the risk of peritonitis remains a concern, especially in patients with compromised immune systems. Peritonitis in CAPD patients typically occurs when bacteria enter the peritoneal cavity through the catheter. These bacteria can come from various sources, including the skin, the environment, or contaminated dialysis fluid. Once inside the peritoneal cavity, the bacteria can multiply and cause inflammation and infection. The clinical presentation of peritonitis can vary depending on the severity of the infection. Common symptoms include abdominal pain, cloudy dialysis effluent (the fluid drained from the abdomen), fever, and chills. In severe cases, patients may experience nausea, vomiting, and

diarrhea. The diagnosis of peritonitis is typically made based on clinical findings and laboratory tests. A sample of the dialysis effluent is sent for culture to identify the causative bacteria. White blood cell count and other inflammatory markers may also be elevated. The treatment of peritonitis involves prompt administration of antibiotics, usually intraperitoneally (directly into the peritoneal cavity) or intravenously. The choice of antibiotic depends on the suspected or identified bacteria. In some cases, surgery may be necessary to remove the infected peritoneal catheter. Peritonitis can lead to various complications, including sepsis, abscess formation, and even death. Sepsis is a life-threatening condition that occurs when the body's response to an infection damages its own tissues and organs. Abscesses are collections of pus that can form within the abdomen. Preventing peritonitis is crucial in CAPD patients. Strict adherence to aseptic techniques during dialysis exchanges is essential. Patients should be educated on proper catheter care and hygiene. Regular monitoring for signs and symptoms of peritonitis is also important. Peritonitis often requires hospitalization for close monitoring, intravenous antibiotic administration, and supportive care. The length of hospitalization can vary depending on the severity of the infection and the presence of complications. Peritonitis can significantly disrupt a patient's life, requiring temporary interruption of CAPD and potentially leading to other complications.[14-16]

Continuous ambulatory peritoneal dialysis (CAPD) is a lifeline for individuals with end-stage renal disease (ESRD), offering a more flexible and patient-centered approach to renal replacement therapy compared to traditional hemodialysis. However, CAPD is not without its challenges, and the presence of comorbidities, particularly in older adults, can significantly complicate the clinical course and increase the risk of complications, including peritonitis. The interplay of older age, peritonitis, and comorbidities creates a particularly challenging clinical scenario that demands comprehensive and individualized care. As individuals age, they experience a natural decline in physiological reserve, which refers to the body's ability to withstand stress and recover from illness. This decline can manifest in various ways, such as decreased kidney function, reduced immune response, and impaired wound healing. Older CAPD patients are therefore more vulnerable to the effects of comorbidities and the complications associated with CAPD, including peritonitis. Peritonitis, an infection of the peritoneum (the lining of the abdominal cavity), is a serious complication of CAPD that can lead to sepsis, a life-threatening condition characterized by the body's overwhelming response to an infection. The presence of a peritoneal catheter, a tube surgically inserted into the abdomen to facilitate dialysis, increases the risk of peritonitis by providing a potential entry point for bacteria into the peritoneal cavity. Comorbidities, or co-existing medical conditions, are highly prevalent in older adults with ESRD. Common comorbidities include diabetes, cardiovascular disease, and malnutrition. These conditions can further compromise immune function, making older CAPD patients even more susceptible to peritonitis and other infections. The combination of older age, peritonitis, and comorbidities creates a complex interplay of factors that can significantly impact the clinical course and outcomes of CAPD patients. Older patients with peritonitis may have a more severe course of illness due to their decreased physiological reserve and the potential presence of other comorbidities. This can lead to longer hospital stays, a higher risk of complications, and even mortality. For instance, an older CAPD patient with diabetes and peritonitis may have a more difficult time fighting off the infection due to their weakened immune system and impaired wound healing. They may also be more prone to developing complications such as sepsis or abscess formation. The presence of cardiovascular disease can further complicate the clinical picture by affecting blood flow to vital organs, including the kidneys, and increasing the risk of cardiovascular events. The complex interplay of older age, peritonitis, and

comorbidities underscores the importance of individualized care for CAPD patients. Healthcare providers must carefully assess each patient's unique needs, considering their age, comorbidity profile, functional status, and social support system. Close monitoring is essential to detect early signs of complications and intervene promptly. Regular assessments of kidney function, immune response, and wound healing can help identify potential problems and guide treatment decisions. Comprehensive management of comorbidities is also crucial to minimize their impact on overall health and reduce the risk of complications.[17,18]

The findings of this study have significant implications for clinical practice, highlighting the need for a comprehensive and individualized approach to the care of continuous ambulatory peritoneal dialysis (CAPD) patients. By understanding the impact of comorbidities, older age, and peritonitis on hospitalization outcomes, healthcare providers can implement strategies to optimize care, reduce the risk of complications, and improve the overall quality of life for this vulnerable population. Comorbidities, or co-existing medical conditions, are highly prevalent in CAPD patients and can significantly influence their health and well-being. The presence of comorbidities can complicate fluid management, increase the risk of infections, and lead to more complex hospitalizations, all of which can contribute to prolonged lengths of stay (LOS). To address these challenges, healthcare providers should prioritize comprehensive comorbidity management in CAPD patients. Regular screening for common comorbidities, such as diabetes, hypertension, cardiovascular disease, and malnutrition, is essential to identify and manage these conditions early on. Optimizing treatment for existing comorbidities is crucial to minimize their impact on overall health and reduce the risk of complications. This may involve adjusting medications, providing lifestyle counseling, and collaborating with specialists as needed. Implementing preventive strategies can help reduce the risk of complications associated with comorbidities. This may include vaccinations, smoking cessation counseling, and education on healthy lifestyle habits. Peritonitis, an infection of the peritoneum (the lining of the abdominal cavity), is a serious complication of CAPD that can lead to sepsis, a life-threatening condition. Preventing and promptly treating peritonitis is therefore a critical aspect of CAPD care. Healthcare providers should emphasize the importance of strict adherence to infection control measures, including proper hand hygiene, aseptic techniques during dialysis exchanges, and regular catheter care. Patient education plays a vital role in empowering patients to take an active role in preventing peritonitis. This includes providing clear instructions on catheter care, recognizing early signs and symptoms of peritonitis, and seeking prompt medical attention if an infection is suspected. Early recognition and treatment of peritonitis are crucial to minimize the risk of complications and reduce the length of hospitalization. Healthcare providers should be vigilant in monitoring CAPD patients for signs and symptoms of peritonitis, such as abdominal pain, cloudy dialysis effluent, fever, and chills. If peritonitis is suspected, prompt initiation of antibiotic therapy, usually intraperitoneally or intravenously, is essential. CAPD patients, particularly those with multiple comorbidities or older age, often require individualized care plans to address their unique needs. These plans should consider the patient's comorbidity profile, functional status, social support system, and personal preferences. Optimizing medication regimens to minimize drug interactions, side effects, and the pill burden. Tailoring the dialysis prescription to the patient's individual needs, considering factors such as fluid status, electrolyte balance, and residual kidney function. Providing nutritional counseling to address malnutrition and optimize dietary intake. Offering emotional support and counseling to address the psychological and social challenges associated with ESRD and CAPD.[19,20]

5. Conclusion

This study demonstrates that comorbid conditions, older age, and peritonitis are significant predictors of

prolonged hospital stays in CAPD patients. These findings underscore the importance of comprehensive comorbidity management, preventative strategies for peritonitis, and individualized care plans in this population. By addressing these factors, healthcare providers can optimize resource utilization and potentially improve patient outcomes. Future research should explore targeted interventions to mitigate the impact of these predictors on hospitalization length and enhance the quality of life for CAPD patients.

6. References

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