ORIGINAL ARTICLE

CONTENTS

# Assessment and short-term complications of continuous ambulatory peritoneal dialysis (CAPD) in patients at Basrah Teaching Hospital

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## ABSTRACT

**Aim:** This study examines the outcomes of patients undergoing PD to treat renal failure.

**Materials and Methods:** This is a prospective study conducted on patients undergoing continuous ambulatory peritoneal dialysis at Basrah Teaching Hospital. Information about patients and their PD experience was collected and analyzed. The researchers focused on identifying factors related to complications, particularly peritonitis. Peritonitis was diagnosed based on symptoms and the presence of white blood cells in the dialysis fluid.

**Results:** The study included 71 participants, with a slightly higher number of male participants compared to female participants. The primary cause of kidney failure was diabetic nephropathy, affecting over one-third of patients. Diabetes combined with hypertension was the second most common cause. The most common complications experienced by patients were peritonitis, tube obstruction, and surgical site infection. Other, less frequent complications included death, catheter failure, catheter displacement, bleeding, leakage, and bowel injury.

**Conclusions:** Peritonitis is the most common complication of peritoneal dialysis. While other issues can arise, many are treatable and do not harm the dialysis catheter. Proper patient hygiene can significantly reduce the risk of complications and make peritoneal dialysis a successful treatment option.

**KEY WORDS:** complications, peritoneal dialysis, continuous ambulatory dialysis

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## INTRODUCTION

Peritoneal dialysis dated back to late 1940s when Fin et al [1], succeeded irrigating peritoneal cavity for lavage by inserting two stainless inlet and outlet tubes then in 1968, Tenkohff [2] managed to develop his indwelling silicone catheter which facilitated the introduction of continuous peritoneal ambulatory dialysis (CAPD) by Popovich and Moncrief 1976[3].

CAPD is consisting basically of instilling about 3 liters of dialysis fluid (dialysate) through a catheter introduced in the peritoneal cavity for short 3-4 times in a day and long period at the night [4]. Where waste products (urea, creatinine and sodium) transfer by different transport process through peritoneum to the dialysate [5].

CAPD gains popularity since its introduction for several reasons the most important of which may be that it's uncomplicated and easy to use, retain residual renal function in performing dialysis without the need for hospital admission and has less effect on cardiovascular system [6-9].

## AIM

This study examines the outcomes of patients undergoing PD to treat renal failure.

## MATERIALS AND METHODS

This was a single-center, prospective observational study conducted at Al-Basrah Teaching Hospital, Al-Basrah southern of Iraq.

Data collected from medical records was entered and analyzed using Microsoft Excel software.

Descriptive statistics (e.g., frequencies, percentages) were calculated to summarize patient characteristics and complication rates.

Associations between specific patient factors and complication occurrence were explored using appropriate statistical tests (chi-square test).

The study was conducted in accordance and approval was obtained from the relevant ethics committee at Basrah Medical College.

Informed consent was obtained from all participants before data collection and Patient confidentiality was maintained throughout the study.

All serial patients who diagnosed with chronic renal failure and deemed suitable for CAPD by a nephrologist were enrolled in the study over a period of 2 years and 7months (from April 2018 to Nov. 2021).

While patients with active infections, severe comorbidities, or contraindications to CAPD surgery were excluded from the study.

Information gathered included demographics, medical history, CAPD catheterization details, and follow-up complaints recorded at minimum for 12 months post-surgery.

The surgical procedure involved an open approach. Patients were placed in supine position. Local anesthesia (15 ml of 2% Lidocaine) was injected at the incision site, and the patient received a prophylactic dose of the antibiotic ceftriaxone (1 gram intravenously).Then a four-centimeter incision was made on either the left or right side of the patient's abdomen, two centimeters below and lateral to the umbilicus.

The subcutaneous layer is dissected down to the anterior rectus which is opened in same direction and the muscle fibers are bluntly separated until reaching the posterior sheath which incised, and the abdominal cavity is entered after opening the peritoneum. The surgeon examined the abdomen for any adhesions and if any were found near the abdominal wall, they were carefully separated.

Next, the catheter was guided into the abdominal cavity towards the pelvic area.

The intraperitoneal portion is slid off the stylet, and the proximal cuff is positioned in the intermuscular space above the posterior rectus sheath.

The peritoneum and posterior rectus sheaths are closed with absorbable sutures in purse string manner around the catheter taking care to prevent catheter obstruction. The anterior rectus sheath is closed with absorbable suture. A subcutaneous tunnel is then created to the preferred exit site, which is usually lateral and caudal to the entrance site. The distal cuff is placed subcutaneously, 4 cm from the exit site.

After testing the patency of the catheter by filling the pelvic cavity with sterile normal saline, skin is closed.

Although peritonitis can be diagnosed when at least two of the following criteria were met, in this study we depend on the first two bases.

1. Clinical Presentation: Abdominal pain and/or cloudy dialysis fluid.
2. Dialysis Fluid Analysis: A white blood cell count in the dialysis fluid exceeding 100 cells per microliter or 0.1 billion cells per liter, with neutrophils constituting more than 50% of these cells, after a dwell time of at least two hours.
3. Microbiological Confirmation: A positive culture of the dialysis fluid, identifying the causative organism.

Following catheter placement, patients initiated continuous ambulatory peritoneal dialysis (CAPD). A standardized protocol involved instilling 2 liters of sterile dialysate into the peritoneal cavity, which remained in situ for 4–6 hours per dwell cycle. The used dialysate was subsequently evacuated and replaced with fresh fluid, repeating this exchange four times daily. Dialysis solutions are categorized by glucose concentration: lower concentrations (1.36–1.5%) address uremia, intermediate levels (2.27–2.5%) enhance ultrafiltration for edema management, and higher concentrations (3.86–4.5%) provide maximal fluid removal in cases of refractory pulmonary edema. Icodextrin, a glucose-free alternative, is often employed during prolonged daytime dwells to reduce systemic glucose absorption and optimize ultrafiltration efficiency overnight.

## RESULTS

This study enrolled a total of 71 patients. There was a slight skew towards males, with a ratio of 1.3 males to 1 female. This is also reflected in the percentages, where 56.43% of the patients were male and 43.66% were female (Table 1).

The youngest patient was 10 years old, while the oldest was 84, with mean age of 51.6 years (Table 2).

Both blood urea and serum creatinine values exceeded the reference range, as detailed in Table 2.

An analysis of Table 1 reveals the spectrum of factors contributing to renal failure in the studied patients.

Diabetic nephropathy was the leading cause of renal failure, affecting 32.4% (23 patients) of the study group. Diabetes and hypertension combined followed closely, impacting 25.4% (18 patients). Obstructive uropathy accounted for 11.3% (8 patients), with other causes making up the remainder.

Anesthesia choices varied: 44 patients received local anesthesia, 9 received general anesthesia, and 18 received a combined approach local and regional anesthesia.

Different complications encountered in the study group including peritonitis (11 patients), tube obstruction (5 patients), followed by surgical site infection (4 patients), death (4 patients), failure (3 patients), and implant migration (2 patients). Other complications, such as bleeding (2 patients), leakage (2 patients), small bowel injury (1 patient), were less common (Table 3).

**Table 1.** Gender distribution and causes of chronic renal failure

| variables | | no. | percent |
|---|---|---|---|
| Gender | Male | 40 | 56.34 |
| | Female | 31 | 43.66 |
| Causes | Diabetic nephropathy | 23 | 33 |
| | Diabetic neph. + Hypertension | 20 | 28 |
| | Obstructive uropathy | 9 | 13 |
| | Hypertension | 6 | 9 |
| | Glomerulonephritis | 6 | 9 |
| | Nephrotic syndrome | 5 | 7 |
| | Polycystic disease | 2 | 1 |

**Table 2.** Distribution of patients age and blood chemistry

| measures | age | B.Urea | S.creatinine |
|---|---|---|---|
| Mean | 51.5 | 109.55 | 5.11 |
| Median | 57 | 92.5 | 4.7 |
| Mode | 60 | 80 | 6 |
| Standard Deviation | 17.99 | 54.92 | 2.83 |
| Count | 71 | 71 | 71 |

**Table 3.** Complications according to age and sex

| Complications | Age | | sex | | P value |
|---|---|---|---|---|---|
| | <50 | >50 | M | F | |
| Peritonitis | 4 | 7 | 6 | 5 | 1 |
| Obstruction | 2 | 3 | 3 | 2 | 1 |
| Mortality | 2 | 2 | 3 | 1 | 1 |
| SS1 | 2 | 2 | 1 | 3 | 1 |
| Failure | 0 | 3 | 1 | 2 | 1 |
| Insertion site bleeding | 1 | 2 | 2 | 1 | 1 |
| Migration | 2 | 0 | 1 | 1 | 1 |
| Leakage | 1 | 1 | 1 | 1 | 1 |
| Bowel injury | 0 | 1 | 1 | 0 | 1 |

**Table 4.** Episodes of complications

| Complications | No. of episodes | Percentage |
|---|---|---|
| Peritonitis | **24** | **38.7** |
| Tube obstruction | **11** | **17.7** |
| Exit site infection | **9** | **14.5** |
| Pericatheter leakage | **7** | **11.3** |
| Failure | **5** | **8** |
| Mortality | **4** | **6.6** |
| Tube migration | **2** | **3.2** |
| Total | **62** | **100** |

A total of 62 complication episodes were observed during the study period (Table 4). Peritonitis emerged as the most prevalent complication, accounting for 24 episodes (38.7%) of the total. Other documented complications included tube obstruction (11 episodes, 17.7%), exit-site infection (9 episodes, 14.5%), pericatheter leak (7 episodes, 11.3%), failure (5 episodes, 8%), mortality (4 episodes, 6.6%), and tube migration (2 episodes, 3.2%).

## DISCUSSION

A total of 71 patients participated in this study, with an average age of 51.6 (SD = 17.9) years with a male majority of 56.4% and is comparable to other studies which despite variations across regions, men consistently outnumber women in the pool of patients receiving dialysis and kidney transplants worldwide [10-12].

Our study found that diabetes mellitus (32.4%) alone or in combination with hypertension (25.4%) were the leading causes of chronic renal failure, followed by obstructive uropathy (11.3%) and other causes. These findings are consistent with other researches [13-16].

Although there are some studies that mentioned glomerulonephritis as the leading cause followed by diabetes and high blood pressure [17].

Most of our patients (62%) received local anesthesia for the procedure.

This study's overall CAPD complication rate is similar to what has been reported in other studies (18). Complications monitored included peritonitis which remains a critical problem for CAPD programs, leading to program abandonment, decline in patient health (including technique failure), and mortality. This study observed a PD peritonitis rate of 0.38 episodes per patient year, consistent with rates reported in other studies [19-21].

This study observed a peritonitis rate of 0.38 episodes per patient-year, which is consistent with rates reported in other CAPD studies (22-25). Among the 11 patients with peritonitis, the most common causative organism was *Staphylococcus epidermidis* (36.36%), followed by Gram-negative organisms (27.27%) and *Staphylococcus aureus* (9.09%). Poly-microbial and culture-negative peritonitis each accounted for 9.09% of cases, while fungal peritonitis caused by *Candida* species was identified in one patient (9.09%). The total of these percentages is 99.99%, which is effectively 100% when considering rounding limitations.

These findings align with global trends in CAPD-related peritonitis, though the presence of fungal infections and the rates of poly-microbial and culture-negative peritonitis may reflect regional or diagnostic differences [22-25].

The findings of this study are consistent with global trends in CAPD-related peritonitis, with some variations that may reflect regional or diagnostic differences. The high rate of S. epidermidis infections underscores the importance of aseptic technique during dialysis exchanges, while the presence of fungal and poly-microbial infections highlights the need for careful monitoring and tailored management strategies.

Summary of treatment for each type of peritonitis in our study which was based on the causative organism which align with the 2016 ISPD (International Society for Peritoneal Dialysis) guidelines and other relevant literature.

Treatment of peritonitis due to staphylococcus epidermidis intraperitoneal (IP) Vancomycin given at dosing of 15–30 mg/kg body weight, administered intraperitoneally, with repeated doses every 3–7 days for 14 days.

While treatment of Gram-Negative Bacteria (*Escherichia coli* in 2 patients)

Intraperitoneal (IP) Ceftazidime in a dose of: 1–1.5 g intraperitoneally once daily or 500 mg/L in each exchange for 14 days.

While for *Pseudomonas aeruginosa*, intraperitoneal (IP) Ceftazidime for 3 weeks

For fungal infection fluconazole was given as loading dose intravenously (IV) once and then maintenance Dose 200 mg orally for 4 weeks.

For poly-microbial Peritonitis broad-spectrum coverage started with a combination of vancomycin (for Gram-positive coverage) and ceftazidime. Metronidazole was added to cover anaerobic organisms. Treatment given for 2 weeks.

While for culture-negative Peritonitis empirical therapy was started with vancomycin (for Gram-positive coverage) and ceftazidime for 2 weeks.

### PATIENTS WHO NO LONGER RESPONDED WELL TO CAPD WERE SWITCHED TO HEMODIALYSIS

Other complications were catheter-related issues as leaks, exit-site infections, blockages, migration or displacement. Those with obstruction or migration treated by tube replacement.

Exit Site and tunnel infections can occur at the exit site of the catheter or along the tunnel created during catheter placement. Assessment and management of exit site hygiene, such as regular cleaning and dressing changes, are important to prevent infections.

Other infrequent procedure-related complications were bleeding (responded to conservative treatment) and bowel injury which required surgical repair and postponement of dialysis.

It's important to note that while these complications can occur, they are relatively rare, and with proper care and monitoring, most CAPD patients can undergo treatment without experiencing significant issues. Regular follow-up with healthcare professionals and adherence to recommended protocols can help minimize the risk of complications. Four participants passed away during the study. Sepsis was the cause of death in two patients, while the other two deaths resulted from cardiac complications.

## CONCLUSIONS

Peritonitis is the most common complication in peritoneal dialysis (PD) patients. While other complications can occur, many of these are treatable and do not affect the lifespan of the dialysis catheter. By carefully selecting patients who can maintain proper hygiene, PD can be a successful treatment option.

## STRENGTHS AND LIMITATIONS

This study provides valuable insights into outcomes of CAPD in a specific patient population at a single center.

However, the observational design and relatively small sample size limit the generalizability of the findings.

Further research with larger and more diverse study populations is warranted to confirm these results and elucidate potential risk factors for CAPD complications.

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## CONFLICT OF INTEREST

The Authors declare no conflict of interest

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