







# Spectrum of Complications of Patients with Chronic Kidney Disease on Maintenance Continuous Ambulatory Peritoneal Dialysis: An Experience of Tertiary Nephrology Center in Najaf City-Iraq

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## Abstract

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**BACKGROUND:** Chronic kidney disease (CKD), also called chronic kidney failure, is described as gradual loss of kidney function. CKD can progress to end-stage kidney failure, which is fatal without artificial filtering (dialysis) or kidney transplant. Peritoneal dialysis (PD) has a widespread renal replacement therapy with great acceptance because of simplicity, flexibility, and independence.

**AIM:** The aim of this study was to evaluate the complications of continuous ambulatory PD (CAPD) in patients with CKD.

**METHODS:** A cross-sectional study, involved 140 patients, aged between 18 and 80 years old and suffered from CKD under maintenance CAPD in the dialysis unit of the renal center. All data regarding the sociodemographic profile of the patient, vitals, etiological diagnosis, frequency and duration of dialysis, and dialysis-related complications were taken.

**RESULTS:** In the current study, there is a significant difference in the distribution of complications among gender where the female patients had a higher incidence of both infectious and non-infectious complications. The study also reported that there is much lower rate of complications among patients on laparoscope operation in compared with the open operation. In addition, patients with open abdomen PD developed the complications earlier than those with laparoscope maintenance CAPD.

**CONCLUSION:** Peritoneal infection is the most prevalent complication among the other complications in the current study. There is much lower rate of complications among patients on PD in compared with hemodialysis and on laparoscope in compared with the open operation.

## Introduction

Chronic kidney disease (CKD) is a destructive disorder with increasing global burden affecting about 10–13% of populations with over 750 million persons worldwide [1], [2], [3]. It reaching the epidemic levels due to increase the prevalence of its fundamental causes such as diabetes mellitus, hypertension, obesity, and aging process [4]. The global estimated prevalence of this disease is about 13.4% that doubled over the past three decades [5], [6], [7]. It is considered as a leading public health problems including morbidity and mortality, where CKD is considered as the 5<sup>th</sup> growing leading cause of mortality in the world, resulted in 1.2 and 2.4 million deaths in 2019 and 2020, respectively [8], [9], [10].

In Iraq, CKD is ranked among the five most life-threatening disease, where death because of renal failure was about 6879 patients in 2015 according to the statistics of Iraqi Ministry of Health. Females patients had slightly higher mortality rates (6.9/3163) than male (6.1/3716) [11].

The estimation of patients with end-stage kidney disease who need renal replacement therapy (RRT) is between 4.902 and 7.083 million as a result there is a growing need for cost-effective RRT [1], [5].

Peritoneal dialysis (PD) is a method of RRT and it is done by injecting the dialysis fluid that also known as dialysate into the peritoneal cavity by entering a catheter into the anterior abdominal wall and piercing the parietal peritoneum with its tip positioned in the pelvis. The peritoneum and its fenestrated capillary bed are responsible for the exchange of many substances such as electrolytes, glucose, urea, and other small molecules from the blood because it is acting as a semipermeable membrane. The solute is removed from the peritoneal capillaries by a diffusion process and through chemical gradient into the dialysate, while the removal of water done by creation of osmotic gradient by hypertonic dextrose [12], [13].

PD can be done automatically with the help of a machine called a cyclor or continuous ambulatory and this process involves many of exchanges per day

and it is causing infusion and drainage of the solution from the peritoneal cavity using the gravity only. Continuous ambulatory PD (CAPD) is now a preferred mode of the treatment in patients with end-stage renal disease [14]. CAPD does not require advanced technologies, much infrastructure, or need for dialysis staff support, it could be an ideal form of RRT in low-middle-income countries, particularly for those living in remote areas [15].

In acute and chronic renal failure treatment, the procedure of PD has a widespread of acceptance because of many reasons like, simplicity and it is more flexible and independence in addition to lack the need for regular intravascular access that limits daily performance. Furthermore, the preservation of the residual renal function is better and dietary restrictions are less when compared with other types of dialysis treatment such as hemodialysis (HD) [16], [17]. This resulted in use of PD for treatment of renal failure over the past four decades in many hospitals to reach 11% of all RRT [18].

Accordingly, the PD has many of advantages in comparison with HD; it gives the patients more freedom to do daily activities as well as easily use and speed, low cost, and absence for need of highly skilled operator and anticoagulation [19]. In addition, many of data suggest that the transplant outcomes in patients that used PD against HD are improved and myocardial stunning in PD is less, therefore, the PD may be considered as a modality of choice in patients with cardiovascular comorbidities [20], [21], [22]. In addition, quality of life is better in patients on PD than HD [23]. In addition, in patients whom vascular access is challenging, PD is considered as an alternative method of dialysis. PD also provides good control of diabetic complications in diabetic patients on RRT [24].

In spite of these advantages, but the PD has many of potential complications, infectious, and non-infectious. The infectious complications of PD include peritonitis that also known as a technique failure and this considered as the major complication of PD and primary cause that made patients to switch from PD to HD as well as increase risk of morbidity and mortality in addition to increasing treatment cost and hospitalization, infection of the catheter exit site, tunnel infection also reported [25], [26], [27], [28].

While, the non-infectious complications include, dysfunction of catheter, catheter obstruction or poor drainage, edema or leakage of dialysate subcutaneously or as a peritoneal-pleural fistula, peritoneal herniation, intra-abdominal adhesions abdominal wall weakens, and sclerosing encapsulating peritonitis in addition to hydrothorax [19], [29], [30].

The aim of this study was to evaluate the complications of PD in patients with CKD.

## Methods

### Study design and setting

It is a cross-sectional study, involved 140 patients (74 as female and 66 as male), aged between 18 and 80 years old and suffered from CKD under MCAPD in the dialysis unit of the renal center. Patients who diagnosed with acute kidney disease and under PD or HD were excluded from this study.

### Data collection

All CKD patients seeking for maintenance CAPD were observed during the study, many of information were taken regarding the underlying causes of CKD, type of operation, frequency of dialysis, and concomitant complications. Age, gender, and past medical history also taken. Additional information regarding any adverse events during dialysis session and the required management is provided by attending physicians as peer slandered protocol. All data regarding the sociodemographic profile of the patient, vitals, etiological diagnosis, frequency and duration of dialysis, and dialysis-related complications were taken in preformed forma after getting the informed consent from all patients.

**Table 1: Baseline characteristics of patients undergoing continuous ambulatory peritoneal dialysis**

Baseline variables	No.	%
Age (years)		
18–38	46	32.8
39–59	49	35
60–80	45	32.2
Gender		
Male	66	47
Female	74	53
Complication		
Present	48	34.2
Absent	92	65.7
Type of operation		
Open method	12	8.5
Laparoscopy	128	91.5
History of medical disease		
Hypertension	80	57.1
Diabetic	18	12.8
Anemia	78	55.7
Total	140	100

### Statistical analysis

Statistical analysis was performed using SPSS version 18 (Statistical Package for the Social Science), using frequency, mean and standard deviation. When  $p \leq 0.05$ , it was considered statistically significant for described variables.

## Results

From the total 140 patients, there were 74 (53%) as females and 66 (47%) as male. Table 1 shows the demographic and baseline characters of

the patients with CKD under CAPD. Results of Table 2 indicated that there is a significant difference in the presence or absence of complications according to the gender ( $p \leq 0.05$ ). Table 3 showed that there is no significant difference in the presence or absence of complications according to the age ( $p \geq 0.05$ ).

**Table 2: Distribution of presence and absence of complications according to the gender of study population**

Gender	Complications		Total	p-value
	Present	Absent		
Male	14	51	65	0.003
Female	34	41	75	
Total	48	92	140	

The result of Table 4 showed that there is a significant difference in the values of hemoglobin, urea ( $p \leq 0.05$ ), and a highly significant difference in the level of creatinine ( $p \leq 0.0001$ ) before and after dialysis process. Figure 1 shows the distribution of complications according to the type of operation that used in CAPD either open method or laparoscopy.

Figure 2 showed the distribution of infection according to time of occurrence after CAPD either by open method or laparoscopy.

**Table 3: Distribution of presence and absence of complications according to the age of study population**

Age (years)	Complications		Total	p-value
	Present	Absent		
18–38	20	26	46	0.21
39–59	16	33	49	
60–80	12	33	45	
Total	48	92	140	

## Discussion

In the current study, there is a significant difference in the distribution of complications among gender and the female patients had a higher incidence of both infectious and non-infectious complications. This could attribute to that peritoneum attach with uterus that which open with vagina to urethra and those female more liable for UTI because of poor controlled the complete evacuation process of urinary bladder [31], where the complicated UTI has a higher risk of chronicity, recurrence, and/or progression and may be associated with severe disease progression [32], this explained by vaginal infections that serving as a potential reservoir for urinary tract infecting microorganism in female patients [33]. In addition, the normal female urinary tract has a comparatively short urethra, as a result carries an inherent predisposition to proximal seeding of bacteria [34].

**Table 4: Values of hemoglobin, urea, and creatinine before and after peritoneal dialysis for the patients of the study**

Pair		Mean±SD	Correlation	p-value
	Post-dialytic hemoglobin	9.283±1.520		
Pair 2	Pre-dialytic urea	181.151±63.83	0.208	0.014
	Post-dialytic urea	134.501±61.712		
Pair 3	Pre-dialytic creatinine	8.356±3.3389	0.366	0.0001
	Post-dialytic creatinine	6.634±2.826		

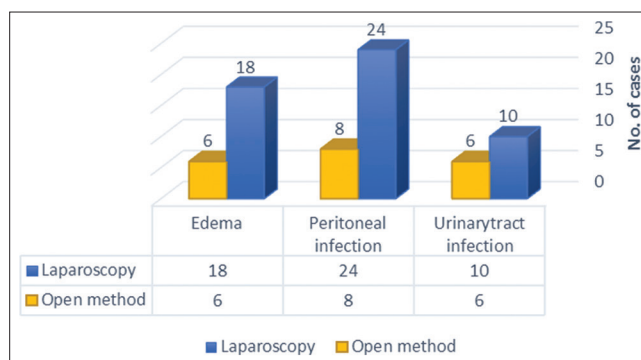


Figure 1: Distribution of complications according to the type of operation

Furthermore, the results showed that there is no significant difference in the distribution of complications among age, but the study showed that there is about two-third of the patients in the study who were more than 38 years and the median age is  $46.69 \pm 16.6$  years, this can be explained by increasing the incidence of CKD and their underlying risk factors, especially diabetic mellitus and hypertension, also there is a growing evidence of age-related renal function decline as shown by Hill *et al.*, 2016, who showed that the prevalence of CKD increased with age [35]. A study by Chou *et al.*, 2019, also showed increasing in the incidence of ESRD in elderly patients with CKD [36].

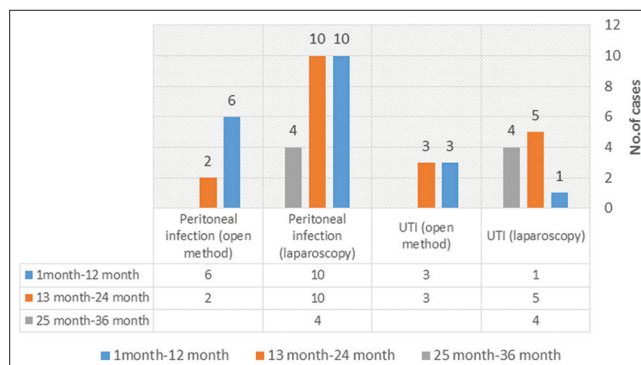


Figure 2: Distribution of infection according to time of occurrence

During the study period, there are 140 patients on MCAPD and the study reported that there is much lower rate of complications, especially peritonitis among patients on laparoscope operation in compared with the open operation, these results were comparable with Bircan and Kulah, 2015, study and Okpechi *et al.*, 2020, study respectively [37], [38]. In addition, patients with open abdomen PD developed the complications earlier than those with laparoscope MCAPD.

The laparoscope process shown a minimal invasive, more acceptable, and higher safety profile in addition to better outcome and less incidence of catheter obstruction and change in comparison with the open operation, accordingly, there is a universal orientation toward laparoscope PD operations [39], [40]. This reflects the large number of patients with laparoscope PD in the current study and clinicians preference of laparoscopic over open CAPD in the current study.

Furthermore, when compared with HD, this type of RRT is more preferred [41] and utilized treatment that affords medical and lifestyle benefits to the patient and financial savings to the health-care system [42].

In addition, when compared our results, we found that the frequency of complication is much lower than that of HD that documented in the previous studies. A study by Bartaula *et al.* reported that the complications were documented in 58.3% of the patients [43], while in this study, the complications occurred in about 34.2%, this could be attributed to the. Another study by Mehrotra *et al.*, 2016, also documented the results of several studies that proven the reduce the rate of complications with improved survival rate in ESRD patients on PD compared with HD, these results were parallel with the current results [44].

Peritoneal infection or peritonitis is the most prevalent complication among the other complications in the current study. Comparable results were reported in several earlier clinical studies worldwide [45]. This complication could be associated with increase hospitalization, treatment cost, as well as raising the rate of mortality [25].

When compare the rate of peritonitis in the current study with the rates that documented by previous study by Okpechi *et al.* [38]. We noted that this study showed a lower rate of complications, this could be attributed to intensive and continuous training of medical staff who responsible for performing of laparoscopes in addition to the continuous patients follow-up as well as the rational and specific selection of patients who legible to undergo maintenance CAPD to lowers as possible CAPD-related complications.

This study also showed that 55.7% of patients were anemic. Male patients showed a relatively higher level of hemoglobin, this result was relatively similar to previous results [46], [47] that showed the prevalence of anemia in CKD at different stages and differences in the levels of hemoglobin between male and female, respectively. This result is well predicted since anemia is one of the popular complications of CKD [48] and it increases the risk of CKD progression [49]. Anemia is more frequent in female and could be worsened by hemorrhagic effluent or hemorrhagic complications of dialysis.

Edema was also reported in both laparoscopic and open abdomen maintenance CAPD, especially genital edema but with less prevalence among laparoscopic PD. It is considered as one of the established noninfectious complications of PD. It is a common manifestation of dialysate leakage from the peritoneal cavity through a defect in the abdominal wall caused by hernias; peritoneal tears; leaks around the dialysis catheter; trauma; fluid overload; and malignancy [50].

Both blood urea and serum creatinine levels were significantly lowered after PD, this reflects the success of RRT that promotes preserving or even improvement of renal function among patients on dialysis.

Finally, hemoglobin level also had been improved after dialysis, despite this improvement not result in correction of anemia, but it is statistically significant. This might be related to the elimination of uremic toxins through PD.

## Conclusion

Peritoneal infection or peritonitis is the most prevalent complication among the other complications in the current study. There is much lower rate of complications among patients on PD in compared with HD and on laparoscope operation in compared with the open operation.

## Statement of Ethics

Patients have given their written informed consent and that the study protocol was approved by the institute's committee on human research.

## Authors' Contributions

Evan Hameed: Study design, drafting the article, and data collection. Rawaa Shareef: Data collection, interpretation of the data, and analysis. Yasir Sharba and Zahraa Sharba: Contribute equally to this work. All authors read and approved the final manuscript.

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