# Non-infectious complications of continuous ambulatory peritoneal dialysis and their impact on technique survival

**J. Prakash, L. K. Sharatchandra Singh, S. Shreeniwas, B. Ghosh, T. B. Singh**

Department of Nephrology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

## ABSTRACT

Data on non-infectious complications of continuous ambulatory peritoneal dialysis (CAPD) are sparingly reported from different centres of the country. We studied the non-infectious complications in patients of end stage-renal disease (ESRD) undergoing CAPD. Double-cuffed straight catheter was inserted in all patients using the surgical method and CAPD was started on the 15$^{th}$ day of catheter insertion. The nature of non-infectious complications was noted during follow-up in these patients. Forty-five (male 31, female 14) patients with the mean age of 54.5±11.6 years were studied. Diabetic nephropathy was the most common (59.5%) cause of ESRD. Overall, non-infectious complications were noted in 18/45 (40%) cases. Ultrafiltration failure was the most common (15.5%) followed by incisional hernia (6.6%), exit site leak (4.4%), hydrothorax (4.4%), catheter malposition (4.4%), scrotal swelling (2.2%) and hemoperitoneum (2.2%). Patients with ultrafiltration failure were either shifted to hemodialysis or underwent renal transplantation. The remaining (62%) non-infectious complications did not affect the catheter survival and CAPD could be continued. Non-infectious complications occurred in 40% of our CAPD patients and ultrafiltration failure was the most common (15.5%). A majority (62%) of the complications did not affect catheter survival.

**Key words:** Catheter survival, continuous ambulatory peritoneal dialysis, non-infectious complications, ultrafiltration failure

## Introduction

Non-infectious complications of continuous ambulatory peritoneal dialysis (CAPD) are increasing in importance in parallel to reduced peritonitis rates. They arise from insertion and maintenance of the PD catheter in the peritoneal cavity, the increase in intra-abdominal pressure caused by dialysate and metabolic effects of the absorption of glucose and its byproducts. Catheter-related problems are the major causes of technique failure and account for approximately 20% of change to hemodialysis (HD).[1,2] Ultrafiltration failure (UFF) is the most important transport abnormality in long-term continuous ambulatory peritoneal dialysis (CAPD) implying both a large effective peritoneal vascular surface area and impaired transcellular water transport.[3] The prevalence of UFF increases from 3% after one year on CAPD to 31% after six years. The aim of this study was to describe non-infectious complications of CAPD in our setup and their impact on the technique survival.

**Address for correspondence:**
Dr. Jai Prakash, Department of Nephrology, Institute of Medical Sciences, Banaras Hindu University, Varanasi - 221 005, Uttar Pradesh, India.
E-mail: jpojha555@hotmail.com

| Access this article online | |
|---|---|
| Quick Response Code: | Website: www.indianjnephrol.org |
| | DOI: 10.4103/0971-4065.82125 |

## Materials and Methods

This observational study was carried out in 45 patients of end stage-renal disease (ESRD) undergoing CAPD. We studied the non-infectious complications in those patients occurring during the course of therapy. Double-cuffed straight Tenckhoff catheter was inserted in all patients using the surgical technique. Flushing of the catheter was done on the fifth and ninth days after insertion , and regular CAPD was started on the 15$^{th}$ day. All patients were followed up at an interval of at least six weeks or earlier if they had any problem. The duration of follow-up ranged between one and 72 months.

The non-infectious complications were defined as descibed below. hydrothorax: Pleural fluid resembling dialysate with high glucose concentration of ≥300-400 mg/dl and

lactate dehydrogenase level <100 IU/ml. Ultrafiltration failure (UFF): net UF volume < 400 ml after 4 h of fluid dwell with 2 L of 4.25% dextrose dialysis solution, dialysate leak: development of any moisture around the catheter that had a high glucose level. It was divided between early and late if it was noted before or after 30 days and hemoperitoneum: prolonged collection of blood in the peritoneal cavity.

## Results

The demographic profile of 45 (31 males; 14 females) patients is shown in Table 1. The mean age was 54.5±11.6 years. Diabetic nephropathy was the commonest cause of ESRD. The duration of CAPD ranged from one to 72 months. Table 2 shows the duration of PD. Non-infectious complications were observed in 18 (40%) patients. Ultrafiltration failure was the most common non-infectious complication, observed in seven (15.5%) patients. Three patients with UFF were shifted to hemodialysis and two patients underwent living related renal transplantation. Scrotal swelling and hemoperitoneum were observed in one case each [Table 3]. Hemoperitoneum occurred within three months of catheter insertion, was of uncertain etiology and the patient died of bleeding. The catheter had to be removed in six (13.3%) cases. The reason and time of removal of functioning catheter are given in Table 4. Catheter reinsertion was done in four patients. Coronary artery disease was the most common cause of death in 14 (60.8%) patients followed by sepsis related to peritonitis in eight (34.8%) cases.

**Table 1: Demographic profile of patients on continuous ambulatory peritoneal dialysis (*n* = 45)**

| | |
|---|---|
| Total number of patients | 45 |
| Mean age (years) | 54.5 ± 11.6 |
| Male | 31 (68.8) |
| Female | 14 (31.1) |
| Non-infectious complications | 18/45 (40) |
| Removal of functioning catheter | 6 (13.3) |
| Catheter reinsertion | 4 (8.9) |
| Renal transplantation | 2 (4.4) |
| Shift to hemodialysis | 3 (6.7) |

Figures in parentheses are in percentage

**Table 2: Duration of continuous ambulatory peritoneal dialysis**

| Duration (months) | Number | Percentage |
|---|---|---|
| 0-1 | 4 | 8.8 |
| 1-6 | 10 | 22.2 |
| 6-12 | 6 | 13.3 |
| 12-24 | 6 | 13.3 |
| 24-36 | 4 | 8.8 |
| 36-48 | 5 | 11 |
| 48-60 | 4 | 8.8 |
| 60-72 | 5 | 11 |
| >72 | 1 | 2.2 |
| Total | 45 | 100 |

**Table 3: Non-infectious complications of continuous ambulatory peritoneal dialysis**

| Complication | Number of cases |
|---|---|
| Ultrafiltration failure | 07 (15.6) |
| Incisional hernia | 03 (6.7) |
| Exit site leak | 02 (4.4) |
| Hydrothorax | 02 (4.4) |
| Catheter malposition | 02 (4.4) |
| Scrotal swelling | 01 (2.2) |
| Hemoperitoneum | 01 (2.2) |

**Table 4: Time of removal of functioning continuous ambulatory peritoneal dialysis catheter due to peritonitis**

| Patients | Nature of peritonitis | Time of removal (months) |
|---|---|---|
| 1 | Pseudomonas | 4 |
| 2 | Fungal | 4 |
| 3 | Refractory | 5 |
| 4 | Pseudomonas | 8 |
| 5 | Fungal | 9 |
| 6 | Refractory | 18 |

## Discussion

Non-infectious complications of CAPD are classified into two groups on the basis of onset from the time of insertion of catheter: early onset (one to four months) and late onset (12-24 months). Early-onset complications include exit site leak, catheter malposition, hemoperitoneum, right-sided hydrothorax and ultrafiltration failure (UFF). The late-onset complications include abdominal hernia, scrotal swelling, encapsulated peritonitis and catheter cuff protrusion.[4] This study mainly describes CAPD catheter-related mechanical complications and UFF. Ultrafiltration failure is the most common peritoneal transport abnormality in long-term CAPD.[5-7] We noted UFF in seven (15.5%) CAPD patients. The major causes of UFF are the decrease in osmotic gradient related to increased peritoneal absorption of glucose, a large vascular peritoneal surface area, or decrease in the ultrafiltration coefficient of the peritoneum.[6,7]

The incidence of dialysate leak is 5-20% in CAPD patients, but this percentage probably underestimates early leaks.[8-12] We found leaks in five (exit site two; hydrothorax two; scrotal swelling one) cases. An association has been found between early leaks (≤30 days) and immediate CAPD initiation and midline catheter insertion.[8] Early leakage most often manifests as a peri-catheter leak.[12-15] The exit site leak is associated with two major problems.[16] First, these patients require the discontinuation of CAPD and transfer to hemodialysis while the leak abates. Second, such leaks can lead to some infectious complications, either peritonitis or an exit site infection requiring antibiotic therapy. Rarely, the leak may require the removal of the

catheter.[9-11] We noted exit site leak in two (4.4%) patients who required temporary transfer to hemodialysis and CAPD was later resumed in both of them. Late leaks may present more subtly with subcutaneous swelling and edema, weight gain, peripheral or genital swelling (24-56%).[10,15-22] Hernias are less common in continous cycling peritoneal dialysis patients, presumably because of the lower inra-abdominal pressure during recumbency. Overall, hernias occur in about 20% of the CAPD population Incisional, umbilical, inguinal and ventral hernias were reported in 30%, 38%, 17% and 15% of patients respectively.[23] We observed incisional hernia in 6.7% of our patients. Genital swelling is a common complication.[10,15,17-21] It is generally caused by patent processus vaginalis (24-56%). Sometimes peritoneal damage leads to edema shortly after the insertion of a CAPD catheter. We came across only one (2.2%) patient with this problem. Surgical repair has been strongly suggested for leakage causing genital swelling.

Under the influence of raised intra-abdominal pressure, dialysate can leak to the pleural cavity leading to hydrothorax. The incidence of hydrothorax is unknown. Early-onset hydrothorax mostly occurs within 24 h following the initiation of PD session and disappears rapidly on discontinuation of PD. Delayed-onset large hydrothorax is also reported. One study reported a 5% incidence of hydrothorax in the CAPD population.[24] Hydrothorax most commonly affects older females, is rare in children and is predominantly right-sided. Dyspnea is the first clinical clue.[12] Obese patients and those on steroids are more likely to have leaks. Diaphragmatic leaks present with pleural effusion, almost always right-sided in the first few weeks of PD and made worse by use of more hypertonic fluids.[12,15] Massive hydrothorax is an indication for temporary transfer to hemodialysis which may permit a spontaneous closure of a diaphragmatic defect. The correction of a pleuroperitoneal communication or diaphragmatic defect can also be achieved by pleurodesis.[24] We observed hydrothorax in two (4.4%) patients and both were treated successfully with pleurodesis.

The incidence of malposition varies between 0 and 22%, depending on the center experience, type of catheter, and insertion technique.[1,9,25] Two (4.4%) of our patients developed catheter malposition which required reinsertion. We came across hemoperitoneum in one (2.2%) case. Recurrent hemoperitoneum is a benign complication (3-4%) of CAPD,[9,26] with no significant long-term effect on patient survival, predisposition to peritonitis, or UFF. The mean time interval before the first hemoperitoneum episode from commencement of PD was 10.5 months (range 1–37 months, SD 9.7 months).[26] Though we did not come across cases of encapsulating peritoneal sclerosis (EPS), it has been reported in 0.7-3.3%[27-32] The mean catheter survival in the present study was 31 months. Eleven percent of patients could continue the procedure for up to six years and only 2.2% patients had catheter survival beyond six years.

In summary, the overall non-infectious complications of CAPD in our patients were 40%. The functioning catheters were removed in six (13.3%) patients because of Pseudomonal, refractory or fungal peritonitis. The majority of non-infectious complications in these patients were treatable and did not interfere with the catheter survival.

## References


1. Schaubel DE, Blake PG, Fenton SS. Trends in CAPD technique failure: Canada, 1981-1997. Perit dial Int 2001;21:365-71.
2. Mujais S, Story K. Peritoneal dialysis in the US: Evaluation of outcomes in contemporary cohorts. Kidney Int 2006;103:S21-6.
3. Ho-dac-Pannekeet MM, Atasever B, Struik D, Krediet RT. Analysis of ultrafiltration failure in peritoneal dialysis patients by means of standard peritoneal permeability analysis. Perit Dialy Int 1997;17:144-50.
4. Peppelenbosch A, van Kuijk WH, Bouvy ND, van der Sande FM, Tordoir JH. Peritoneal dialysis catheter placement technique and complications. Nephrol Dial Transplant 2008;S4:iv23-8.
5. Ho-dac-Pannakeet MM, Atasever B, Struik D, Krediet RT. Analysis of ultrafiltration failure in peritoneal dialysis patients by means of standard peritoneal permeability analysis. Perit Dial Int 1997;17:144-50.
6. Selgas R, Fernandes-Reyes MJ, Bosque E, Bajo MA, Borrego F, Jimenez C, *et al*. Functional longevity of the human peritoneum: How long is continuous peritoneal dialysis possible? Results of a prospective medium-term study. Am J Kidney Dis 1994;23:64-73.
7. Monquil MC, Imholz AL, Struik D, Krediet RT. Does impaired transcellular water transport contribute to net ultrafiltration failure during CAPD? Perit Dial Int 1995;15:42-8.
8. Leblanc M, Ouimet D, Pichette V. Dialysate leaks in peritoneal dialysis. Semin Dial 2001;14:50-4.
9. Scarpioni R. Acute hydrothorax in a peritoneal dialysis patient: Long-term efficacy of autologous blood cell pleurodesis associated with small-volume peritoneal exchanges. Nephrol Dial Transplant 2003;18:2200-201.
10. Çakır B, Kırbaş İ, Çevik B, Ulu EM, Bayrak A, Coşkun M. Complications of continuous ambulatory peritoneal dialysis: Evaluation with CT. Diagn Interv Radiol 2008;14:212-20.
11. Bargman JM. Complications of peritoneal dialysis related to increasd intraabdominal pressure. Kidney Int 1993;103:S75-80.
12. Garcia-Urena MA, Rodriguez CR, Ruiz VV, Hernández FJ, Fernández-Ruiz E, Gallego JM, *et al*. Prevalence and management of hernias in peritoneal dialysis patients. Perit Dial Int 2006;26:198-202.
13. Crabtree JH. Hernia repair without delay in initiating or continuing peritoneal dialysis. Perit Dial Int 2006;26:178-82.
14. Del peso G, Bajo MA, Costero O. Risk factors for abdominal wall complications in peritoneal dialysis patients. Perit Dial Int 2003;23:249-54.
15. Szeto CC, Chow KM. Pathogenesis and management of hydrothorax complicating peritoneal dialysis. Curr Opinion Pulm Med 2004;10:315-9.
16. Schwenk MH, Spinowitz BS, Charytan C. Dialysate leak in continuous ambulatory peritoneal dialysis. In: Nissenson AR, Fine RN, editors. Dialysis therapy third edition. Philadelphia:

Hanley and Belfus; 2004. p. 271.
17. Diaz-Buxo IA. Mechanical complications of chronic peritoneal dialysis catheters. Semin Dial 1991;4:106-11.
18. Kopecky RT, Funk MM, Kreitzer PR. Localized genital edema in patients undergoing continuous ambulatory peritoneal dialysis. J Urol 1985;134:880-84.
19. Robson WL, Leung AK, Putnins RE, Boag OS. Genital edema in children on continuous ambulatory peritoneal dialysis. Child Nephrol Urol 1990;10:205-10.
20. Tzamaloukas AH, Gibel LI, Eisenberg B. Scrotal edema in patients on CAPD: Causes, differential diagnosis and management. Perit Dial Transplant 1992;21:581-90.
21. Wetherington OM, Leapman SB, Robison RJ, Filo RS. Abdominal wall and inguinal hernias in continuous ambulatory peritoneal dialysis patients. Am J Surg 1985;150:357-60.
22. Van Asseldonk IP, Schroder CH, Severijnen RS, De long MC, Monnens LA. Infectious and surgical complications of childhood continuous ambulatory peritoneal dialysis. Eur J Pediatr 1992;151:377-80.
23. Schwenk MH, Spinowitz BS, Charytan C. Abdominal hernia in continuous ambulatory peritoneal dialysis. In: Nissenson AR, Fine RN, editors. Dialysis therapy third edition. Philadelphia: Hanley and Belfus; 2004. p. 269-70.
24. Schwenk MH, Spinowitz BS, Charytan C. Hydrothorax and peritoneal dialysis in continuous ambulatory peritoneal dialysis. In: Nissenson AR, Fine RN, editors. Dialysis therapy. 3rd ed. Philadelphia: Hanley and Belfus; 2004. p. 272-74.
25. Allon M, Soucie M, Macon El. Complications with permanent peritoneal dialysis catheters: Experience with 154 percutaneously placed catheters. Nephron 1988;48:8-11.
26. Kai-Chung TS, Pok-Siu YI, Man-Fei LA, Fu-Keung LI, Bo-Ying C, Tak-Mao C, *et al*. Recurrent hemoperitoneum complicating continuous ambulatory peritoneal dialysis. Perit Dial Int 2002;22:488-91.
27. Summers AM, Clancy MJ, Syed F, Hsrwood N, Brenchley PE, Augustine T, *et al*. Single-center experience of encapsulating peritoneal sclerosis in patients on peritoneal dialysis for end-stage renal failure. Kidney Int 2005;68:2381-8.
28. Rigby RJ, Hawley CM. Sclerosing peritonitis: The experience in Australia. Nephrol Dial Transplant 1998;13:154-9.
29. Kawanishi H, Moriishi M. Epidemiology of encapsulating peritoneal sclerosis in Japan. Perit Dial Int 2005;25:S14-8.
30. Kwaguchi Y, Kawanishi H, Mujais S. Encapsulating peritoneal sclerosis: Definition, etiology, diagnosis and treatment: ISPD Adhoc Committee on Ultrafiltration Management in Peritoneal Dialysis. Perit Dial Int 2000;20:S43-55.
31. Nakamoto H. Encapsulating peritoneal sclerosis: A clinician's approach to diagnosis and medical treatment. Perit Dial Int 2005;25:S30-8.
32. Campbell S, Clarke P, Hawley C. Sclerosing peritonitis: Identification of diagnostic, clinical and radiological features. Am J Kidney Dis 1994;24:819-25.

**How to cite this article:** Prakash J, Sharatchandra Singh LK, Shreeniwas S, Ghosh B, Singh TB. Non-infectious complications of continuous ambulatory peritoneal dialysis and their impact on technique survival. Indian J Nephrol 2011;21:112-5.

**Source of Support:** Nil, **Conflict of Interest:** None declared.