Original Article

# Outcomes of HIV-infected Patients on Dialysis: Experience at a Tertiary Care Center


## Abstract

**Background:** Human immunodeficiency virus (HIV) infection is a major public health problem. These patients are at an increased risk for end-stage kidney disease. Both hemodialysis (HD) and continuous ambulatory peritoneal dialysis (CAPD) are the accepted modalities of treatment. **Materials and Methods:** In this retrospective study, we included all HIV-positive end-stage kidney disease (ESKD) patients who were on dialysis – HD or CAPD – for at least 1 month. Data were collected from the dialysis charts and analyzed. **Results:** There were 20 patients in the CAPD group and 76 patients in the HD group. Mean age was 49.6 ± 8.73 years in the CAPD group and 46.28 ± 9.02 years in the HD group. Hypertension and diabetes were the common causes for ESKD. Mean survival was slightly better in CAPD group (20.94 vs. 15.46 months). The HD group had higher mortality within 12 months of dialysis initiation, and infection was the cause for early deaths. Mean infection episodes was 2.1 in HD group and 3.1 in CAPD group. CAPD patients with low albumin (<2.5 g/dl) had higher peritonitis rates. **Conclusion:** Managing HIV-positive dialysis patients remains challenging. In our study, survival was marginally better in the CAPD group. In both groups, low CD4 count was associated with more infections and low albumin with more peritonitis episodes. A study incorporating more peritoneal dialysis (PD) patients, longer follow-ups, and a matched non-HIV control will throw more light on patient outcomes.


**Keywords:** *HIV and CAPD, HIV and dialysis, HIV and hemodialysis, HIV dialysis outcomes, HIV-related kidney disease*


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## Introduction

Human immunodeficiency virus (HIV) infection is a major public health problem, having claimed millions of lives worldwide. There are over 39 million people infected with this virus. The incidence of new HIV infections is declining; in the last decade, it has fallen by 39% and mortality has decreased by 51%. In India, which has the third highest HIV population in the world, new cases are declining in recent years. Improvements in the living conditions, better access to health care, huge mobilization of funds by governments worldwide to control HIV, and improved management of opportunistic infections have increased the life span of HIV patients. The introduction of anti-retroviral therapy (ART) has brought about a decline in mortality and improvement in life expectancy.[1] As patients survive longer, some of them will develop medical problems like diabetes, hypertension, cardiovascular problems, and complications due to HIV *per se*. All these can increase the risk for acute and chronic kidney diseases, which are more common in HIV patients than in the general population.[2] The increased risk could be either due to infection-related factors like viral load, CD4 counts, coexisting infections, and drug toxicity or traditional risk factors for Chronic kidney disease (CKD), such as diabetes, hypertension, and cardiovascular diseases, or a combination of both. These comorbidities will make the patients suffer from end-stage kidney disease (ESKD) much earlier, necessitating dialysis or transplant.[3]

Both hemodialysis (HD) and continuous ambulatory peritoneal dialysis (CAPD) are accepted modalities for patients with HIV and ESKD.[4] There is no clear proof that one form of dialysis scores over the other in terms of patient survival. The hypothesis that HD increases morbidity by increasing the viral load through activation of leukocytes and release of cytokines has never been proven. CAPD may cause lesser immune activation and cytokine release, but more protein loss in the effluent and more infection episodes.[5] CAPD has the benefit of no venepuncture and no blood loss and reduces nosocomial infections. The risk to the health-care providers is higher in HD compared to CAPD, which increases



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even further in advanced stages of HIV due to the higher viral load.[6] No difference in survival was observed between HD and CAPD, indicating that the modality was not so important compared to the stage of HIV infection.[7] Despite all the advances in dialysis technology, mortality in HIV ESKD still remains high compared to non-HIV, even among young adults.[8] Indian data with regards to the outcome are sparse.

In the present study, we look at the outcomes of HIV patients on dialysis, both HD and peritoneal dialysis (PD), and the factors influencing the outcomes.

## Materials and Methods

This retrospective study was undertaken at St. Johns National Academy of Health Sciences. We included all HIV-positive ESKD patients who underwent dialysis over a 10-year period. Patients were on HD or CAPD for at least 1 month before inclusion. Patients had HIV infection before they reached ESKD. For CAPD, a Tenckhoff catheter was surgically placed. Patients opting for HD were initiated through temporary jugular catheter and later continued through arteriovenous (AV) fistula. Data were collected from the dialysis charts and outpatient and inpatient records. Pediatric cases, those with incomplete records, and patients who were lost to follow-up were excluded.

Data regarding demography, comorbidities, details of dialysis, hematology and biochemical parameters, CD4 counts, infection episodes, hospitalizations, and mortality information were collected and analyzed. Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) 16 software. Summary statistics was done with proportion, mean, standard deviation (SD), and interquartile range (IQR). Inferential statistics was done using Chi-square test, independent *t*-test, and Mann–Whitney test.

Ethical committee approval was obtained from the institution's review board.

## Results

Males outnumbered females in both HD and CAPD groups, but between the two groups, the ratio was comparable (CAPD 9:1, HD 5.9:1).

Most of the patients were in the age group 41–60 years (17 in CAPD and 49 in HD group). Mean age in the CAPD group was 49.6 ± 8.73 years and in the HD group was 46.28 ± 9.02 years (*P* =: 0.1433) [Table 1].

Hypertension and diabetes were present in 96% and 58.5% of the study population, followed by ischemic heart disease in 25% cases. Some patients had coinfection with hepatitis B and hepatitis C virus [Table 1]. Common causes for ESKD were diabetic nephropathy (48.45%) and chronic interstitial nephritis (14.43%). There was no difference between the groups with regards to the cause of ESKD (*P* value = 0.275), as shown in Table 1.

**Table 1: Demographics of the study population**

| | CAPD group (20) | | HD group (76) | | Total number (%) |
|---|---|---|---|---|---|
| | Male | Female | Male | Female | |
| Age (years) | | | | | |
| 18–40 | 1 | 1 | 18 | 5 | 25 (26.04%) |
| 41–60 | 16 | 1 | 43 | 6 | 66 (68.8%) |
| >61 | 1 | 0 | 4 | 0 | 5 (5.2%) |
| Comorbidities | | | | | |
| Diabetes mellitus | 13 (65%) | | 40 (51.94%) | | 53 (55.2%) |
| Hypertension | 20 (100%) | | 71 (92.20%) | | 91 (94.8%) |
| Ischemic heart disease | 5 (25%) | | 19 (24.67%) 24 | | |
| Stroke | 2 (10%) | | 4 (5.19%) | | |
| HBV positive | 2 (10%) | | 7 (9.09%) | | |
| HCV positive | 2 (10%) | | 10 (12.98%) | | |
| Others | 10 | | 23 | | |
| Cause of ESKD | | | | | |
| DN | 12 (60%) | | 35 (45.45%) | | 47 (48.45%) |
| Hypertensive nephrosclerosis | 3 (15%) | | 6 (7.79%) | | 9 (9.27%) |
| Chronic interstitial nephritis | 3 (15%) | | 18 (23.37%) | | 21 (21.64%) |
| Chronic glomerulonephritis (FSGS/MPGN/IgA nephropathy) | 0 (0%) | | 14 (18.18%) | | 14 (14.43%) |
| HIVAN | 1 (5%) | | 2 (2.59%) | | 3 (3.09%) |

CAPD=continuous ambulatory peritoneal dialysis, ESKD=end-stage kidney disease, DN=diabetic nephropathy, HBV=hepatitis B virus, HCV=hepatitis C virus, HD=hemodialysis, HIVAN=HIV-associated nephropathy, FSGS=Focal segmental glomerulosclerosis, MPGN=Membranoproliferative glomerulonephritis

Survival was slightly better in the CAPD group, but it was not statistically significant. Mean survival was 20.94 months in the CAPD group and 15.46 months in the HD group [Table 2].

The HD group had higher mortality (72.13%) within 12 months of dialysis initiation. There were 22 deaths within 3 months of starting HD. Infection was the leading cause of mortality in the HD group (62.29%) and cardiovascular diseases in the CAPD group (55.55%).

Mean infection episodes were 2.1 in the HD group and 3.1 in the CAPD group (*P* = 0.0116) [Table 2]. Peritonitis was the predominant infection in the CAPD group (75%). Total number of peritonitis episodes was 25. Number of peritonitis episodes/patient/year was [(25 × 365.2)/13,500] = 0.676 episodes/patient/year. Coagulase-negative *Staphylococcus* and *Pseudomonas* were the most common etiologic agents in 35.71% of patients in each group. The culture was negative in 21.42% of patients. Three patients required CAPD catheter removal. Catheter-related blood stream infection (50%) and

respiratory infection (47.36%) were predominant in the HD group. Out of 22 early deaths in the HD group, infection was the cause of death in 14 patients (14/22).

In the CAPD group, there were four cases of tuberculosis and two fungal infections (oral and esophageal), but none had fungal peritonitis. In the HD group, nine patients had fungal infection.

Mean CD4 count in the HD group was 284.92 ± 247.62 (range 11–1466) and in the CAPD group was 285.55 ± 120.72 (range 21–596). Of the 22 infection-related deaths in the HD group, 19 had CD4 <200/µl and 16 of them were not on ART. In the CAPD group, there were seven infection-related deaths, of which two had CD4 <200/µl and two were not on ART.

CAPD was the preferred Renal replacement therapy (RRT) modality in 12 patients due to logistic reasons. In the remaining patients, PD was considered due to vascular access problems.

Mean hospitalization days was more in the CAPD group (7.31 vs. 4.61), but it was not significant. Also, 79.22% of patients in the HD group and 65% cases in the CAPD group required less than five days of hospitalization during the study period [Table 2].

Mean hemoglobin (Hb) was 7.94 ± 1.34 g/dl in the HD group and 9.8 ± 3.89 g/dl in the CAPD group ($P$ = 0.0007). Hb% was better maintained in the CAPD group.

Mean serum albumin was 2.64 ± 0.58 g/dl in the HD group and 2.68 ± 0.3 g/dl in the CAPD group ($P$ = 0.7672). There was no significant difference in albumin level between the two groups. In CAPD group, there was a negative relationship between serum albumin and peritonitis rates ($R$ = −0.078, $P$ = 0.7437). Fourteen patients in the CAPD group and 46 patients in the HD group were on ART ($P$ = 0.606). Commonly used drugs in the HD group were lamivudine (54.54%), nevirapine (41.55%), and stavudine (27.27%) and in the CAPD group were lamivudine (65%), nevirapine (45%), and stavudine (45%).

There was a negative relationship between the CD4 count and infection episodes in both CAPD and HD groups [Table 3].

**Table 2: Comparison of outcomes between HD and CAPD groups**

| | HD | CAPD | *P* |
|---|---|---|---|
| Mean follow-up in months | 34.45±85.78 | 22.65±16.15 | 0.542 |
| Mean survival in months | 15.46<br>SD 22.39 | 20.94<br>SD 20.20 | 0.322 |
| Mortality within 12 months | 44 (72.13%) | 6 (33.33%) | 0.0085 |
| Mortality within 24 months | 9 (14.75%) | 5 (27.77%) | |
| Mean hospitalization days | 4.61<br>SD 5.58 | 7.31<br>SD 8.03 | 0.0834 |
| Cause of mortality | | | |
| Infection | 38 (62.29%) | 7 (38.88%) | 0.04 |
| Cardiovascular | 14 (22.95%) | 10 (55.55%) | |
| Mean number of infection episodes | 2.1 | 3.1 | 0.011 |

CAPD=continuous ambulatory peritoneal dialysis, HD=hemodialysis

**Table 3: CD4 count and infection**

| Patient group | *R* | *P* |
|---|---|---|
| HD | −0.2443 | 0.0334 |
| CAPD | −0.0269 | 0.91356 |

CAPD=continuous ambulatory peritoneal dialysis, HD=hemodialysis. There is a negative relationship between CD4 count and infection episodes in both CAPD and HD groups

## Discussion

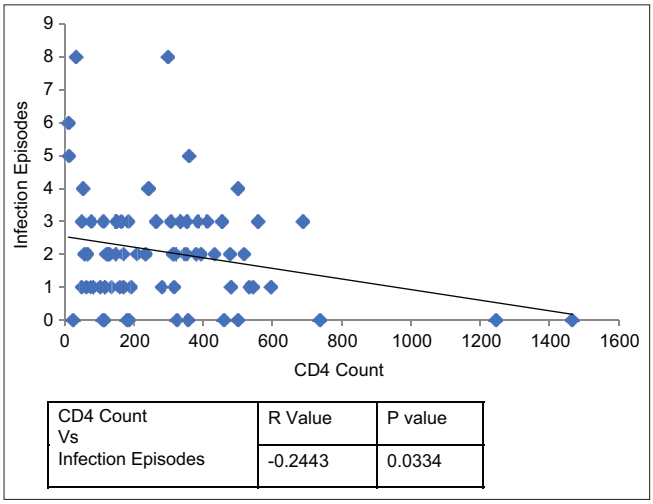
Many previous studies have shown that both HD and CAPD are very well accepted dialysis modalities for HIV patients.[4] Our study looks at the patient outcomes in both modalities and some factors influencing these outcomes. The mean survival on dialysis in our study was 18.2 months. All our patients were relatively stable and in the early stages of HIV infection at dialysis initiation. Although median survival in our study was slightly better in the CAPD group, it was not statistically significant. This could be due to reduced average follow-up time or the small sample size in the CAPD group. Many studies have shown that the modality of dialysis is not a major factor influencing survival.

In a study by Soleymanian *et al.*,[4] both modalities gave similar results. They reported that the choice should be based on patient preference, logistical issues, social conditions, and familiarity of the health-care staff to a particular modality. Another study by Ahuja *et al*.[7] showed no difference in survival between HD and CAPD. CAPD may confer a lower risk, especially in the initial 2 years of dialysis initiation, but after that the mortality risk equals that of HD.[9] In a study by Schoenfeld *et al*.,[10] overall survival after starting dialysis was 46%, 30%, 23%, and 10% at the end of 1, 2, 3, and 4 years, respectively. Another study by Halle *et al*.,[11] reported that the median survival of patients with advanced-stage HIV for both HD and PD was 15.1 months (range 1.6–17.3), whereas for early-stage HIV, it was 61.2 months (range 6.8–116.6). A French study which included HD patients on Highly active antiretroviral therapy (HAART) showed the 2-year survival rate was 89% ± 2% and was statistically indistinguishable from the non-HIV control cohort.[12] The introduction of HAART has improved survival in dialysis patients and it increases the CD4 count above 200/µl. In our study, 60% in the HD group and 70% patients in the CAPD group were on HAART.

Most deaths in the HD group in our study occurred within 1 year of starting dialysis, but after 1 year, CAPD showed a nonsignificant rise in mortality. In the HD group, 18 deaths occurred in the first 3 months of starting HD. Sepsis was the cause of early death in 14/18 cases and the most common source was catheter-related blood stream infection. Most patients who chose HD were initiated through temporary uncuffed central lines and later underwent AV fistula construction. This could have been one of the factors for early infections.

Infections are the major cause of morbidity and mortality in HIV patients. In our study, mean infection episodes was more in CAPD group (3.1 vs. 2.1) and infections were the cause of death in 62% and 39% of patients in HD and CAPD groups, respectively. In the present study, more infections were observed in both groups with CD4 <400/µl. In the CAPD group, there were 19 episodes of peritonitis in patients with CD4 <400/µl (14/20 patients had at least one episode of peritonitis). In a study involving HD patients in Cameroon, sepsis was the cause of death in 41% of patients.[11] Outcome predictors were low CD4 cell count, high viral load, not taking ART, and infections (10). Increased mortality was observed in patients with CD4 <200/µl and serum albumin <2.5 g/dl.[13] Several studies have reported a higher peritonitis rate and infections with unusual organisms like *Pseudomonas* and fungi in HIV CAPD patients.[14]

In the present study, we did not find any difference between serum albumin and survival in both groups, but in the CAPD group, we did observe more peritonitis episodes in the low-albumin group (<2.5 g/dl; not statistically significant) [Figure 1]. This could have been due to shorter follow-up period (mean ± SD: 22.65 ± 16.15). Low serum albumin increases the risk for mortality and peritonitis in PD patients. HIV-associated malnutrition can further decrease the albumin levels. Not just the initial serum albumin, but also the albumin trends over time will influence the clinical outcomes. Early hypoalbuminemia with further drop in 6 months portends poor outcome in the CAPD group.[15] Even in the HD group, higher serum albumin and higher time-averaged albumin can lower mortality.[10,16]




| CD4 Count Vs Infection Episodes | R Value | P value |
|---|---|---|
| | -0.2443 | 0.0334 |

**Figure 1:** CD4 count and infection in hemodialysis patients.

## Conclusion

Managing HIV-positive dialysis patients remains a challenging task. Our study showed marginally better survival in the CAPD group. In both groups, low CD4 count is associated with more infections and low albumin with more peritonitis episodes. A study incorporating more PD patients, longer follow-up, and a matched non-HIV control group may throw more light on patient outcomes and factors influencing them.

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### Conflicts of interest

There are no conflicts of interest.

## References

1. Lima VD, Hogg RS, Harrigan PR, Moore D, Yip B, Wood E, *et al*. Continued improvement in survival among HIV-infected individuals with newer forms of highly active antiretroviral therapy. AIDS Lond Engl 2007;21:685-92.
2. Rasch MG, Helleberg M, Feldt-Rasmussen B, Kronborg G, Larsen CS, Pedersen C, *et al*. Increased risk of dialysis and end-stage renal disease among HIV patients in Denmark compared with the background population. Nephrol Dial Transplant Off Publ Eur Dial Transpl Assoc-Eur Ren Assoc 2014;29:1232-8.
3. Wyatt CM. Kidney Disease and HIV infection. Top Antivir Med 2017;25:13-6.
4. Soleymanian T, Raman S, Shannaq FN, Richardson R, Jassal SV, Bargman J, *et al*. Survival and morbidity of HIV patients on hemodialysis and peritoneal dialysis: One center's experience and review of the literature. Int Urol Nephrol 2006;38:331-8.
5. Mandayam S, Ahuja TS. Dialyzing a patient with human immunodeficiency virus infection: What a nephrologist needs to know. Am J Nephrol 2004;24:511-21.
6. Ippolito G, Puro V, De Carli G. The risk of occupational human immunodeficiency virus infection in health care workers. Italian Multicenter Study. The Italian Study Group on Occupational Risk of HIV infection. Arch Intern Med 1993;153:1451-8.
7. Ahuja TS, Collinge N, Grady J, Khan S. Is dialysis modality a factor in survival of patients with ESKD and HIV-associated nephropathy? Am J Kidney Dis Off J Natl Kidney Found 2003;41:1060-4.
8. Kimmel PL, Umana WO, Simmens SJ, Watson J, Bosch JP. Continuous ambulatory peritoneal dialysis and survival of HIV infected patients with end-stage renal disease. Kidney Int 1993;44:373-8.
9. Sinnakirouchenan R, Holley JL. Peritoneal dialysis versus hemodialysis: Risks, benefits, and access issues. Adv Chronic Kidney Dis 2011;18:428-32.
10. Schoenfeld P, Rodriguez R, Mendelson M. Patients with HIV infection and end-stage renal disease. Adv Ren Replace Ther 1996;3:287-92.

11. Halle MP, Edjomo AM, Fouda H, Djantio H, Essomba N, Ashuntantang GE. Survival of HIV infected patients on maintenance hemodialysis in Cameroon: A comparative study. BMC Nephrol 2018;19:166.
12. Tourret J, Tostivint I, du Montcel ST, Bragg-Gresham J, Karie S, Vigneau C, *et al*. Outcome and prognosis factors in HIV-infected hemodialysis patients. Clin J Am Soc Nephrol 2006;1:1241-7.
13. Ndlovu KCZ, Sibanda W, Assounga A. Peritonitis outcomes in patients with HIV and end-stage renal failure on peritoneal dialysis: A prospective cohort study. BMC Nephrol 2017;18:48.
14. Tebben JA, Rigsby MO, Selwyn PA, Brennan N, Kliger A, Finkelstein FO. Outcome of HIV infected patients on continuous ambulatory peritoneal dialysis. Kidney Int 1993;44:191-8.
15. Jones CH, Newstead CG, Wills EJ, Davison AM. Serum albumin and survival in CAPD patients: The implications of concentration trends over time. Nephrol Dial Transplant 1997;12:554-8.
16. Chen J-B, Cheng B-C, Yang C-H, Hua M-S. An association between time-varying serum albumin level and the mortality rate in maintenance haemodialysis patients: A five-year clinical cohort study. BMC Nephrol 2016;17:117.