

Five-Year Survival Rate of Patients with End-Stage Renal Disease on Continuous Ambulatory Peritoneal Dialysis (CAPD) at Malang CAPD Center, Indonesia

Atma Gunawan^{1*}, Pandu Tridana Sakti²

¹Division of Renal and Hypertension, Departement of Internal Medicine, Faculty of Medicine, Brawijaya University - Dr. Saiful Anwar Hospital, Malang, Indonesia.

²Departement of Internal Medicine, Faculty of Medicine, Brawijaya University, Malang, Indonesia.

*** Corresponding Author:**

Atma Gunawan, MD., PhD. Division of Renal and Hypertension, Departement of Internal Medicine, Faculty of Medicine, Brawijaya University. Jl. JA. Suprpto no. 2, Malang, Indonesia. Email: atma_gunawan.fk@ub.ac.id.

ABSTRACT

Background: Continuous Ambulatory Peritoneal Dialysis (CAPD) is an alternative therapy for renal replacement in patients with kidney failure in developing countries such as Indonesia. The CAPD program in Malang Indonesia has been running since 2010. Until now, there has been little research on the mortality of CAPD therapy in Indonesia. We aimed to provide report on the characteristics and 5-year survival of CAPD therapy in patients with end-stage renal disease (ESRD) in developing countries like Indonesia. **Methods:** We conducted a retrospective cohort study involving 674 patients with end-stage renal disease receiving CAPD therapy from the medical records of the CAPD Center RSUD Dr. Saiful Anwar from August 2014 to July 2020. The 5-year survival rate was analyzed using Kaplan-Meier, and the hazard ratio was analyzed using Cox regression. **Results:** Of 674 patients with end-stage renal disease who underwent CAPD, 63.2% survived up to 5 years, with general survival rates at 1, 3, and 5 years of 80%, 60%, and 52%, respectively. The 3-year survival rate for patients with end-stage renal disease and comorbid hypertension was 80%, while it was 10% for patients with comorbid hypertension and type II diabetes mellitus. The hazard ratio for patients with end-stage renal disease who had comorbid hypertension and type II diabetes mellitus was 8.4 (95% CI = 6.36-11.21). **Conclusion:** Patients with end-stage renal disease who receive CAPD therapy have a favorable 5 years survival rate. Patients with end-stage renal disease on CAPD therapy who have comorbid hypertension and type II diabetes mellitus have a lower survival rate than patients with comorbid hypertension alone.

Keywords: Survival, end stage renal disease, continuous ambulatory peritoneal dialysis.

INTRODUCTION

Continuous Ambulatory Peritoneal Dialysis (CAPD) may be the primary option for efficient and cost-effective renal replacement therapy for end-stage renal disease in developing countries such as Indonesia. Despite the fact that CAPD is better tolerated in patients with end-stage renal disease, it is more cost-effective than hemodialysis (HD).¹ The annual cost of HD per patient in Indonesia is approximately 12,000

USD, while the cost of CAPD is approximately 6,000 USD. Furthermore, CAPD has fewer requirements in terms of medical personnel and facilities than HD. Therefore, the use of CAPD in developing countries can help to bridge the gap between the demand and supply of renal replacement therapy (RRT) for patients with end-stage renal disease.

The number of active patients with end-stage renal disease in Indonesia until 2018 was 132,142

patients (499 patients per million population), while new cases of end-stage renal disease in 2018 were 53,940, with hypertensive kidney disease (36%) and diabetic nephropathy (27.8%) being the most common etiologies. East Java Province has the highest number of active CAPD patients in Indonesia, with 561 patients, 75% of whom came from the CAPD center of RSUD Dr. Saiful Anwar Malang.²

In Indonesia, hypertension (42%) and diabetes mellitus (16%) are the most common comorbidities in patients with end-stage renal disease.² CAPD also has serious complications, such as peritonitis, which can progress to systemic infection.³ These comorbidities and complications can increase the mortality of CAPD patients and decrease their survival rate. There are currently no reports on the therapeutic success and survival analysis of patients with end-stage renal disease who undergo CAPD in developing countries like Indonesia. Patients with end-stage renal disease and hypertension alone or in combination with diabetes mellitus still have a low survival rate. We aimed to analyze the five-year survival of CAPD patients with end-stage renal disease caused by hypertension alone or in combination with diabetes mellitus at one of Indonesia's CAPD centers.

METHODS

The study design was a retrospective cohort study. The research was conducted at the CAPD unit of RSUD Dr. Saiful Anwar Malang, using medical record data of CAPD patients. The target population of this study was patients with end-stage renal disease who were undergoing CAPD therapy. Data is collected using medical records and telephone interviews for additional data not found in the medical record. The inclusion criteria of the study were patients with end-stage renal disease who underwent CAPD installation surgery at Dr. Saiful Anwar Malang from August 2014 to July 2020. The exclusion criteria included CAPD drop-out patients for reasons other than death and CAPD patients traveling to other CAPD centers.

This study was approved by the Health Research Ethics Commission dr. Saiful Anwar Hospital, Malang, Indonesia (Reference no.

400/083/K.3/102.7/2022).

The patient's comorbidities were the confounding variable in this study. The sample size required to determine the difference in survival rates of patients with end-stage renal disease who had comorbid hypertension alone versus hypertension and type 2 diabetes mellitus was 190 samples with a 0.05 significance level and 80% study power with a 0.15 effect size rate.

The SPSS 25 program was used for the survival analysis. Kaplan-Meier analysis was used to distinguish the 5-year survival rate between patients with end-stage renal disease who had comorbid hypertension alone and those who also had hypertension and type 2 diabetes mellitus. Cox regression analysis was used to determine the adjusted hazard ratio (HR) with a 95% confidence interval (CI). The p-value of <0.05 indicates a significant value.

RESULTS

During the period of August 2014 to July 2020, there were 840 CAPD operations at the CAPD Center of Dr. RSUD. Saiful Anwar Malang. From the total of 840 cases, 166 cases (19.5) dropped out of CAPD (due to mechanical problems, recurrent peritonitis, switching to other renal replacement therapies, or traveling to another CAPD center) were excluded from this study. As a result, this study involved 674 patients. Within 5 years, there were 248 deaths (29.5%) with cardiovascular disease being the leading cause of death (79.8%). The sample in this study was male (58.8%), the highest age group when starting CAPD therapy was 46-59 years (42.6%), and hypertension was the most common comorbid condition (57.7%).

Table 1. Characteristics of CAPD Patients

Characteristic	N=674 n (%)
Gender	
Men	389 (58.8)
Women	285 (41.2)
Age	
12-25 years	61 (9.1)
26-45 years	195 (28.9)
46-59 years	287 (42.6)
>60 years	120 (17.8)

Marital status	
Single	61 (9.1)
Married	613 (90.9)
Smoker	
Yes	287 (42.6)
No	287 (57.4)
History of Hypertension Medication	
Calcium channel blocker	195 (28.9)
Angiotensin-converting enzyme inhibitor	287 (42.6)
Angiotensin receptor blocker	192 (28.48)
Comorbidity	
Hypertension	381 (57.7)
Hypertension and Diabetes Mellitus	278 (42.3)
Cause of Mortality	
Cardiovascular Disease	198 (79.8)
Cerebrovascular Disease	8 (3.2)
Sepsis (peritonitis)	40 (16.1)
Other	2 (0.8)

In general, the survival rate of patients with end-stage renal disease who were receiving CAPD therapy within 12 months (1 year) was 80%, 36 months (3 years) was 60%, and 60 months (5 years) was 52%, with a mean survival rate of 42.4 months (95% CI = 40.3-44.5). Survival rates between 1 and 3 years of patients with end-stage renal disease who had comorbid hypertension and type 2 diabetes mellitus who received CAPD therapy were 61% and 10%, respectively, with a median survival of 16 months (95% CI = 13.6-18.3) and comorbid hypertension alone were 90% and 80%, respectively, with a mean survival of 49.9 months (95% CI = 47.9-51.8). The hazard ratio of patients with end-stage renal disease who had comorbid hypertension and type II diabetes mellitus was 8.4 (95% CI = 6.36-11.21), p-value <0.001.

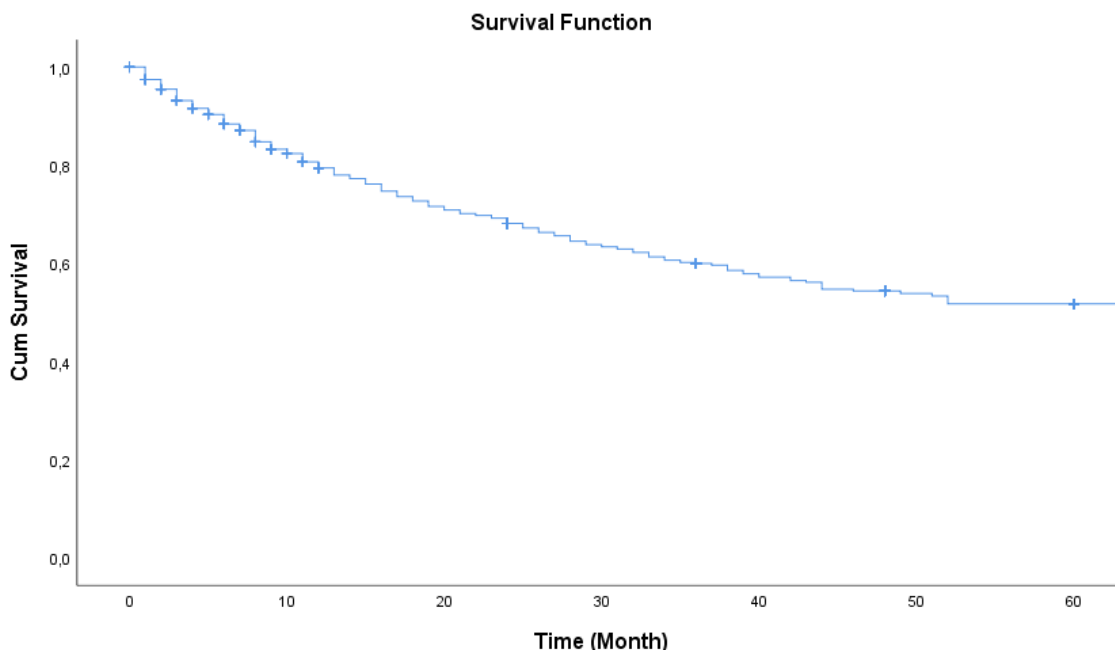


Figure 1. Kaplan-Meier survival curve of patients with the end-stage renal disease treated with CAPD therapy.

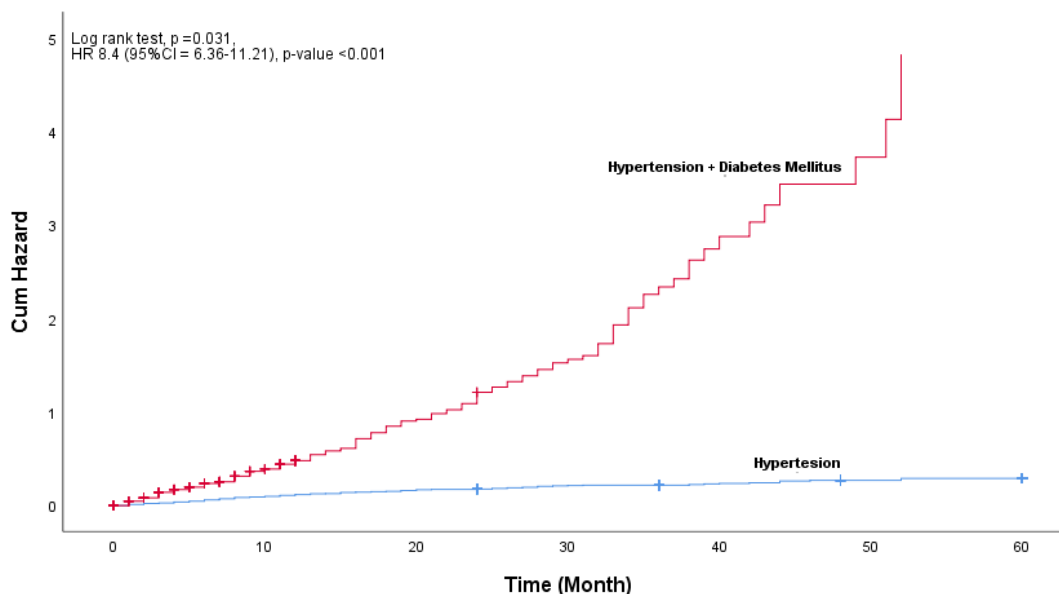


Figure 2. Kaplan-Meier survival curve comparison of CAPD patients with end-stage renal disease who had comorbid hypertension and those who had hypertension and type II diabetes mellitus.

DISCUSSION

The survival rate of end-stage renal disease patients undergoing CAPD therapy in this study was 80% after one year, 60% after three years, and 52% after five years, with a mean survival rate of 42.4 months (95%CI = 40.3-44.5), the same as in several other studies. Research in Hong Kong from 2002 to 2006 found that the patients survived for one year (90.8%), three years (68.2%), and five years (48.4%).⁴⁻⁶ In Thailand, the 2012 survival rates of CAPD patients were one year (79.2%), three years (66%), and five years (57%).⁷⁻⁹ In China, the 2006 survival rates for CAPD patients were one year (94%), three years (81%), and five years (64%).¹⁰ In continental Europe, the 2012 survival rate of CAPD patients was two years (81.7%).¹¹ In the United States, the 2013 survival rates for CAPD patients were one year (90%), two years (79%), and five years (50%).¹¹ In Canada, the 2013 survival rates for CAPD patients were one year (94%), three years (73%), and five years (55%).¹² In Latin America, the 2000 survival rates for CAPD patients were one year (91%), three years (77%), and five years (58%).¹² These data show that both developing and developed countries have nearly the same 5-year survival rate of CAPD, which is above 50%. Recent

research on CAPD mortality showed that 248 patients (36.8%) died, while 426 patients (63.2%) survived for five years. CAPD peritonitis is the second leading cause of 40 (16.1%) mortality cases after cardiovascular disease. The most common bacteria causing CAPD peritonitis was coagulate-negative *Staphylococcus*, with as many as 15 (37.5%) cases.¹³

The survival analysis of patients with end-stage renal disease on CAPD therapy with comorbidities revealed that survival at 1 and 3 years was 61% and 10% for hypertensive patients with type 2 diabetes mellitus, respectively, and 90% and 80% for patients with only comorbid hypertension, respectively. According to a 2013 research conducted in Australia in, the survival rate of CAPD patients with comorbid diabetes was 1 year (89%), 3 years (61%), and 5 years (39%).¹⁴ This is similar to the 2013 New Zealand study, which found that CAPD patients survived for one year (89%), three years (59%), and five years (34%).¹⁴ These data show that patients with end-stage renal disease who have comorbid diabetes have a lower survival rate.

Hyperfiltration in diabetes is caused by efferent arteriolar vasoconstriction due to an activated renin-angiotensin-aldosterone system (RAAS). However, it has become increasingly

evident over the years that hyperglycemia is not the sole cause of nephropathy, despite inarguably playing a major role. Several pathophysiologic pathways are involved in the development of nephropathy, and this review will attempt to elucidate those pathways and, hopefully, shed some light on therapeutic options that may one day play a role in halting the nephropathy epidemic and suppressing the progression to ESRD.¹⁵ In clinical practice, physicians should pay special attention to CAPD patients with diabetes mellitus and hypertension comorbidity.

There were several limitations to this study, including the fact that there were 15 patients who did not have comorbid hypertension and diabetes mellitus, so we did not analyze them and only made an analysis for the survival rate of patients who did. Because the retrospective data for the last 5 years recorded in medical records is insufficient, including data on the etiology of ESRD, data on whether or not hypertension and diabetes mellitus are controlled, and data on other characteristics and comorbidities, we cannot include them in the sample characteristics. The inability to determine the survival status of some patients in the study population had a negative impact on the internal and external validity of the study's main result - the cumulative survival probability -as well as the ability to correlate the study's independent variables to patient survival. A template or format may be used to improve the quality of documentation in the future. At least two phone numbers should be requested from the patient to ensure adequate communication. It is also recommended that similar research be conducted on a regular basis for CAPD patients. This may be addressed by improving community awareness of the disease, introducing self-examination concepts, and providing screening services.

CONCLUSION

This study was conducted to improve understanding of the CAPD patients in Malang. CAPD patients have a survival rate of 80% within 12 months (1 year), 60% within 36 months (3 years), and 52% within 60 months (5 years). Diabetes was found to have a negative impact on the survival of CAPD patients. The survival

rate of end-stage renal disease with diabetes and hypertension is lower than hypertension alone.

CONFLICT OF INTEREST

The author declares no conflict of interest or funding in this research.

REFERENCES

1. Li PK-T, Chow KM, Van de Luijngaarden MWM, et al. Changes in the worldwide epidemiology of peritoneal dialysis. *Nat Rev Nephrol*. 2017;13(2):90–103.
2. Indonesia PN. 11th Report of Indonesian renal registry 2018. Jakarta Perhimpun Nefrol Indones. 2018
3. Witowski J, López-Cabrera M. Peritoneal dialysis and its local and systemic complications: From the bench to the clinic. *Front Physiol*. 2020;11:188.
4. Canney M, Er L, Antonsen J, Copland M, Singh RS, Levin A. Maintaining the uptake of peritoneal dialysis during the covid-19 pandemic: a research letter. *Can J Kidney Heal Dis*. 2021;8:2054358120986265.
5. Klomjit N, Kattah AG, Cheungpasitporn W. The cost-effectiveness of peritoneal dialysis is superior to hemodialysis: Updated evidence from a more precise model. *Kidney Med*. 2021;3(1):15.
6. Sukul N, Mukhopadhyay P, Schaubel DE, et al. Peritoneal dialysis and mortality, kidney transplant, and transition to hemodialysis: trends from 1996-2015 in the United States. *Kidney Med*. 2020;2(5):610–9.
7. Thurlow JS, Joshi M, Yan G, et al. Global epidemiology of end-stage kidney disease and disparities in kidney replacement therapy. *Am J Nephrol*. 2021;52(2):98–107.
8. Wouk N. End-stage renal disease: Medical management. *Am Fam Physician*. 2021;104(5):493–9.
9. Hansson JH, Finkelstein FO. Peritoneal dialysis in the United States: Lessons for the Future. *Kidney Med*. 2020;2(5):529.
10. Wu C, Chen X, Ying Wang A, et al. Peritoneal dialysis in Sichuan province of China—report from the Chinese National Renal Data System. *Ren Fail*. 2018;40(1):577–82.
11. Preka E, Bonthuis M, Harambat J, et al. Association between timing of dialysis initiation and clinical outcomes in the paediatric population: an ESPN/ERA-EDTA registry study. *Nephrol Dial Transplant*. 2019;34(11):1932–40.
12. Prasad B, Jafari M, Shah S, McNaught C, Diebel L. Barriers to peritoneal dialysis in Saskatchewan Canada: results from a province-wide survey. *Can*

- J kidney Heal Dis. 2020;7:2054358120975545.
13. Sianturi DA, Gunawan A. Peritonitis as the cause of death of CAPD patients at RSUD Dr. Saiful Anwar Malang 2014-2020. Clin Res J Intern Med. 2022;3(1):239-44.
 14. McDonald SP. Australia and New Zealand dialysis and transplant registry. Kidney Int Suppl. 2015;5(1):39-44.
 15. Toth-Manikowski S, Atta MG. Diabetic kidney disease: pathophysiology and therapeutic targets. J Diabetes Res. 2015;2015.