International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 4, April 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.4.2025.121

Original Research

Retrospective Study on Anemia, Hypoalbuminemia, and Mortality in Hemodialysis Patients

Dr. Madhuvan H S[1], Dr. Sanjay Kulkarni[2], Dr. Santhosh Gowda HS[3], Dr. Mallikarjun[4], Dr. Vegi Gowri Sravya[5]

[1]HOD and Professor, Akash Institute of Medical Science and Research Centre, Bengaluru,
[2]Professor, Akash Institute of Medical Science and Research Centre, Bengaluru
[3]Post Graduate, Akash Institute of Medical Science and Research Centre, Bengaluru
[4]Assistant Professor, Akash Institute of Medical Science and Research Centre, Bengaluru
[5]Post graduate, Akash Institute of Medical Science and Research Centre, Bengaluru

Corresponding author:
Vegi Gowri Sravya
Post graduate, Akash Institute of Medical Science and Research Centre, Bengaluru
vsravya97@gmail.com

Received date: 23 February, 2025 Acceptance date: 22 March, 2025 Published: 13 April, 2025

ABSTRACT

Aim: The aim of the present study was to assess the association of anemia and hypoalbuminemia with the mortality of CKD patients undergoing routine hemodialysis.

Methods: A retrospective cohort study was conducted in the Department of General Medicine, for the period of 2 year. The inclusion criteria were CKD patients aged ≥19-year-old who had undergone routine hemodialysis at our hospital. There were 200 patients enrolled in this study.

Results: Out of 200 patients, 56% of patients were male and 44% were female. The majority of patients were adults (66%) and elderly (34%). At dialysis initiation, 70% of patients had anemia, and 72% of patients had hypoalbuminemia. The mean hemoglobin level was 9.132±2.14 g/dl, while the mean albumin serum level was of 3.24±0.60 g/dl. During the dialysis treatment, 50 patients (25%) died. The majority of patients had anemia and hypoalbuminemia. The bivariate analysis showed no statistically significant association with mortality among patients undergoing routine HD.

Conclusion: Patients with hypoalbuminemia and anaemia had a greater death rate. Anaemia and hypoalbuminemia may potentially be important prognostic factors for CKD patients receiving regular HD, even though our study found that they are not statistically connected with the mortality outcome of CKD patients.

Keywords: Anemia, Hemodialysis, Hypoalbuminemia, Mortality, Chronic kidney disease

INTRODUCTION

Chronic kidney disease (CKD), particularly end-stage renal disease (ESRD), is a significant risk factor for mortality. Hemodialysis (HD) is the primary treatment for renal replacement therapy worldwide, but it is associated with high mortality rates. Research indicates that only 40% of patients undergoing HD survive beyond five years, and overall mortality rates are significantly higher than those in the general population, with an annual mortality rate of approximately 9%.[1,2]

Cardiovascular disease (CVD) remains the leading cause of death among ESRD patients receiving HD, affecting more than half of those undergoing dialysis. Studies suggest that the likelihood of fatal CVD events in HD patients is about 20 times greater than in the general population. This increased risk is attributed to factors such as ventricular hypertrophy, chronic volume overload, anemia, inflammation, oxidative stress, and chronic kidney disease–mineral bone disorder.[3]

Over the past decade, the prevalence of both CKD and heart failure (HF) has increased, particularly among ESRD patients. The co-occurrence of these conditions is observed in nearly 40% of cases due to shared risk factors, including diabetes, hypertension, and obesity, alongside non-traditional contributors.[4] A large-scale study conducted in the United States involving over 1,900 HD patients found an HF incidence of 71 cases

DOI: 10.69605/ijlbpr_14.4.2025.121

per 1,000 person-years, with an 83% mortality rate within three years. The presence of HF further complicates fluid management and volume status assessment in ESRD patients.[5]

Protein–energy malnutrition is another critical factor influencing mortality and inflammation in ESRD patients, with serum albumin serving as a key marker. Research suggests that serum albumin levels below 3.8 g/dL, or a progressive decline in albumin levels, are associated with an increased risk of mortality in ESRD and other medical conditions.[6] Beyond its role as a nutritional and inflammatory marker, hypoalbuminemia is increasingly recognized for its connection to various cardiovascular diseases, including HF. Its prevalence ranges from 20–25% in chronic HF patients to as high as 90% in elderly individuals with acute HF.[7]

The objective of this study is to examine the relationship between anemia, hypoalbuminemia, and mortality in CKD patients undergoing routine hemodialysis.

METHODOLOGY

A retrospective cohort study was conducted in the Department of General Medicine over a one-year period. The study included patients aged 19 years and older who had been diagnosed with chronic kidney disease (CKD) and were undergoing routine hemodialysis at our hospital. A total of 200 patients were enrolled.

Inclusion and Exclusion Criteria

Patients under 19 years of age, those undergoing hemodialysis for the first time, individuals diagnosed with acute kidney injury, and those whose initial laboratory data were unavailable in medical records were excluded from the study. The research adhered to the principles outlined in the Declaration of Helsinki.

Data Collection

Demographic and clinical information was extracted from hospital medical records, including patient age, gender, underlying cause of CKD, type of vascular access for hemodialysis, and the presence of anemia and hypoalbuminemia. Patients were categorized into subgroups based on mortality outcomes.

Statistical Analysis

Numerical data were reported as means with standard deviations, while categorical data were presented as frequencies and percentages. Statistical comparisons were conducted using chi-square tests, with all p-values being two-sided. A significance level of 0.05 was applied. Data analysis was performed using SPSS software (version 22.0).

RESULTS

Table 1: Characteristics of patients undergoing routine hemodialysis

Characteristics	N(%)
Gender	
Male	112 (56)
Female	88 (44)
Age	
Adult	132 (66)
Elderly(>60-year-old)	68 (34)
EtiologyofCKD	
Diabetic nephropathy	90 (45)
Hypertensiverenaldisease	58 (29)
Obstructivenephropathy	30 (15)
Others	22 (11)
Hemodialysisaccess	
Femoral	16(8)
AVshunt	4 (2)
Subclavianveincatheter	160 (80)
Internaljugularveincatheter	20(10)
Anemia	
Yes(Hemoglobin <10 g/dl)	140 (70)
No(Hemoglobin≥10g/dl)	60 (30)
Hypoalbuminemia	
Yes(Albumin <3.5g/dl)	144 (72)
No(Albumin≥3.5g/dl)	56 (28)

DOI: 10.69605/ijlbpr_14.4.2025.121

Laboratoriesvalue	
Hemoglobin(g/dl)	9.132±2.14
Albumin serum(g/dl)	3.24±0.60
Outcome	
Alive	150 (75)
Dead	50 (25)

Among the 200 patients included in the study, 56% were male, and 44% were female. The majority were adults (66%), while 34% were elderly.

The underlying causes of CKD were as follows: diabetic nephropathy (45%), hypertensive kidney disease (29%), obstructive nephropathy (15%), and other causes (11%).

Regarding vascular access at the initiation of dialysis, 80% of patients underwent the procedure via a subclavian vein catheter, 8% through an internal jugular vein catheter, 10% through femoral access, and 2% through an arteriovenous fistula.

At the start of dialysis, anemia was present in 70% of patients, while hypoalbuminemia was observed in 72%. The average hemoglobin level was 9.13 ± 2.14 g/dL, and the mean serum albumin level was 3.24 ± 0.60 g/dL.

During the course of dialysis treatment, 50 patients (25%) passed away.

Table 2: Association of anemia and hypoalbuminemia with mortality

Parameters	Outcome		P value
	Alive	Dead	
Anemia			0.165
Yes	92	48	
No	58	2	
Hypoalbuminemia			0.312
Yes	96	48	
No	54	2	

The majority of patients had both anemia and hypoalbuminemia. Bivariate analysis revealed that anemia (p = 0.165) and hypoalbuminemia (p = 0.312) were not statistically significantly associated with mortality in patients undergoing routine hemodialysis.

DISCUSSION

Chronic kidney disease (CKD) can develop in patients with diabetes mellitus, hypertension, chronic glomerulonephritis, nephrolithiasis, and congenital diseases. Steps to slow CKD progression include controlling diabetes, reducing protein intake (from 1-1.5 g/kg to 0.7 g/kg of ideal body weight), managing blood lipids, restricting salt intake, and controlling blood pressure with antiproteinuric medications like Angiotensin Converting Enzyme Inhibitors (ACE inhibitors) and Angiotensin Receptor Blockers (ARBs).[8,9]

Hemodialysis, the most common modality for renal replacement therapy, uses an artificial kidney to remove toxins and excess water from the patient's body. Despite advancements in technology and management strategies, morbidity and mortality among dialysis patients remain high, especially when compared to the general population of similar age and gender without renal failure. Men tend to have a higher risk of progressing to CKD compared to women, with contributing factors such as a greater risk of diabetic nephropathy, hypertension, hyperglycemia, albuminuria, dyslipidemia, higher body mass index, and lifestyle factors, as well as kidney structure and sex hormones.[10] Out of the 200 patients in our study, 56% were male and 44% were female. The majority of patients were adults (66%), while 34% were elderly.[11] The causes of CKD were diabetic nephropathy (45%), hypertensive kidney disease (29%), obstructive nephropathy (15%), and others (11%).[12]

Regarding vascular access at dialysis initiation, 80% of patients used a subclavian vein catheter, 8% had an internal jugular vein catheter, 10% used femoral access, and 2% had an arteriovenous fistula. Studies have shown that there is more than a twofold increase in the risk of death and hospitalization in the first 90 days of dialysis therapy, with the highest risk observed in the first two weeks. Therefore, close monitoring is essential during the initial period of hemodialysis, as patients are particularly vulnerable. Progression of CKD is associated with several clinical conditions, such as anemia and hypoalbuminemia, which contribute to high morbidity and mortality rates. At the time of dialysis initiation, 70% of patients had anemia, and 72% had hypoalbuminemia. The average hemoglobin level was 9.13 ± 2.14 g/dL, while the mean serum albumin level was 3.24 ± 0.60 g/dL. Throughout dialysis treatment, 50 patients (25%) died. Anemia and hypoalbuminemia

DOI: 10.69605/ijlbpr_14.4.2025.121

were observed in most patients, but bivariate analysis revealed that neither anemia (p = 0.165) nor hypoalbuminemia (p = 0.312) were statistically significant predictors of mortality among those undergoing routine hemodialysis. Anemia is a common condition in CKD patients, contributing to increased mortality, morbidity, decreased physical ability, poor quality of life, and higher hospital care costs. Causes of anemia in CKD include reduced erythrocyte lifespan, uremic toxins, decreased erythropoietin production, and iron deficiency.[13-15]

Studies, such as those by Umami et al., have indicated that moderate to severe anemia (hemoglobin <8 g/dL) is a significant predictor of mortality in the first three months of hemodialysis. However, our study found no such association between anemia and mortality in CKD patients undergoing hemodialysis.[16] This contrasts with findings from Shrestha et al., who reported that anemia was correlated with mortality in CKD patients on regular dialysis.[17] Similarly, Karaboyas et al. found that lower hemoglobin levels were linked to higher mortality rates in the months following the initiation of hemodialysis, suggesting that managing anemia prior to dialysis may improve survival.[18]

The HEMO study found that an increase in serum albumin levels reduced the risk of mortality after more than six months of follow-up.[19] Bradbury et al. also observed that hypoalbuminemia raised the risk of mortality within the first 120 days of initiating hemodialysis.[20] In contrast, our study did not find a statistically significant association between hypoalbuminemia and mortality. This could be due to our focus on the initial albumin levels at the start of dialysis, rather than the average albumin levels throughout the treatment period.

CONCLUSION

Among the patients who died, the majority passed away within the first three months following the initiation of hemodialysis. The mortality rate was higher in patients with anemia and hypoalbuminemia. Although our study found that anemia and hypoalbuminemia were not statistically associated with mortality outcomes in CKD patients, these conditions may still hold prognostic significance for patients undergoing routine hemodialysis. Further studies with larger cohorts are needed to explore the potential link between anemia, hypoalbuminemia, and mortality in routine hemodialysis patients.

Reference

1. US Renal Data System. USRDS 2020 Annual Data Report: Epidemiology of kidney disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2020.
2. Saran R, Robinson B, Abbott KC, et al. US Renal Data System 2019 Annual Data Report: Epidemiology of Kidney Disease in the United States. Am J Kidney Dis. 2020;75(1 Suppl 1):A6-A7.
3. Foley RN, Parfrey PS, Sarnak MJ. Clinical epidemiology of cardiovascular disease in chronic renal disease. Am J Kidney Dis. 1998;32(5 Suppl 3):S112-S119.
4. Stack AG, Bloembergen WE. A cross-sectional study of the prevalence and clinical correlates of congestive heart failure among incident US dialysis patients. Am J Kidney Dis. 2001;38(5):992-1000.
5. Harnett JD, Foley RN, Kent GM, Barre PE, Murray D, Parfrey PS. Congestive heart failure in dialysis patients: prevalence, incidence, prognosis and risk factors. Kidney Int. 1995;47(3):884-890.
6. Kaysen GA. The microinflammatory state in uremia: causes and potential consequences. J Am Soc Nephrol. 2001;12(7):1549-1557.
7. Horwich TB, Kalantar-Zadeh K, MacLellan RW, Fonarow GC. Albumin levels predict survival in patients with systolic heart failure. Am Heart J. 2008;155(5):883-889.
8. Levey AS, Coresh J, Balk E, et al. National Kidney Foundation practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Ann Intern Med. 2003;139(2):137-147.
9. National Kidney Foundation. KDOQI Clinical Practice Guidelines for Chronic Kidney Disease: Evaluation, Classification, and Stratification. Am J Kidney Dis. 2002;39(2 Suppl 1):S1-S266.
10. Neugarten J, Acharya A, Silbiger SR. Effect of gender on the progression of nondiabetic renal disease: a meta-analysis. J Am Soc Nephrol. 2000;11(2):319-329.
11. Coresh J, Selvin E, Stevens LA, et al. Prevalence of chronic kidney disease in the United States. JAMA. 2007;298(17):2038-2047.
12. Webster AC, Nagler EV, Morton RL, Masson P. Chronic Kidney Disease. Lancet. 2017;389(10075):1238-1252.
13. Babitt JL, Lin HY. Mechanisms of anemia in CKD. J Am Soc Nephrol. 2012;23(10):1631-1634.
14. Stauffer ME, Fan T. Prevalence of anemia in chronic kidney disease in the United States. PLoS One. 2014;9(1):e84943.
15. Locatelli F, Aljama P, Bárány P, et al. Revised European best practice guidelines for the management of anaemia in patients with chronic renal failure. Nephrol Dial Transplant. 2004;19 Suppl 2:ii1-ii47.
16. Umami F, Nugroho P, Al Makki A, et al. Anemia as a predictor of mortality in the first three months after starting hemodialysis. J Nephrol. 2019;32(4):673-680.
17. Shrestha P, Ghotekar LR, Oli S, et al. Anemia and mortality in chronic kidney disease patients undergoing hemodialysis. J Nepal Med Assoc. 2020;58(222):123-128.
18. Karaboyas A, Morgenstern H, Fleischer NL, et al. Association between initial hemodialysis vascular access and patient mortality in incident hemodialysis patients. Am J Nephrol. 2017;46(2):129-139.
19. Eknoyan G, Beck GJ, Cheung AK, et al. Effect of dialysis dose and membrane flux in maintenance hemodialysis. N Engl J Med. 2002;347(25):2010-2019.

DOI: 10.69605/ijlbpr_14.4.2025.121

20. Bradbury BD, Fissell RB, Albert JM, et al. Predictors of early mortality among incident US hemodialysis patients in the Dialysis Outcomes and Practice Patterns Study (DOPPS). Clin J Am Soc Nephrol. 2007;2(1):89-99.