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Original Research Article

Assessing the Association of Anemia and Hypoalbuminemia with the Mortality of CKD Patients Undergoing Routine Hemodialysis: An Observational Study

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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 six months. The inclusion criteria were CKD patients aged ≥19-year-old who had undergone routine hemodialysis at our hospital. There were 100 patients enrolled in this study.

Results: Out of 100 patients, 55% of patients were male and 45% were female. The majority of patients were adults (65%) and elderly (35%). The etiology of CKD included the following: diabetic nephropathy (43%), hypertensive kidney disease (30%), obstructive nephropathy (16%) and others (11%). Regarding vascular access at dialysis initiation, 81% were induced through subclavian vein catheter, 7% through internal jugular vein catheter, 10% through femoral access, and 2% through arteriovenous fistula. At dialysis initiation, 68% of patients had anemia, and 70% of patients had hypoalbuminemia. The mean hemoglobin level was 9.145±2.24 g/dl, while the mean albumin serum level was of 3.27±0.63 g/dl. During the dialysis treatment, 28 patients (28%) died. The majority of patients had anemia and hypoalbuminemia. The bivariate analysis showed that anemia (p value=0.180), and hypoalbuminemia (p value=0.340) were not statistically significant associated with mortality among patients undergoing routine HD.

Conclusion: The mortality rate was higher in patients with anemia and hypoalbuminemia. Although our study concluded anemia and hypoalbuminemia are not statistically associated with mortality outcome of CKD patients, anemia and hypoalbuminemia may still have prognostic importance for CKD patients undergoing routine HD.

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

Introduction

Patients with Diabetes mellitus, hypertension, chronic glomerulonephritis, nephrolithiasis and congenital disease develop chronic kidney disease (CKD). Steps to be taken that can retard the progression of CKD are to control diabetes, decrease protein intake (from 1-1.5 g/kg to 0.7 gm/kg ideal body weight) and blood lipids, restrict salt intake and control blood pressure with antiproteinuric drugs {Angiotensin Converting Enzyme Inhibitors (ACE) and Angiotensin Receptor Blockers (ARBs)}. The most common modality, hemodialysis, uses a machine as an artificial kidney and removes toxins and water from patient's body. Although there are a lot of technological advances and better knowledge of management strategies, morbidity and mortality of dialysis patient remains very high as compared to those in the general population of the same age and gender without renal failure. [1,2] An increased risk of death in chronic dialysis patients has been associated with older age, male gender, white and race non-renal medical comorbidities like cardio-vascular diseases, inadequate dialysis i.e.Kt/v > 1.2/dialysis for thrice weekly dialysis, lower hemoglobin levels i.e. hemoglobin < 11 gm/dl, renal osteodystrophy, inflammation and hypertension. [3-6]

The classification of CKD can be assessed based on the glomerular filtration rates (GFR) which classify it into five stages. The patients with end stage CKD

(stage 5) require renal replacement therapy (hemodialysis). [7] Hemodialysis is one of the renal replacement therapies methods. It uses a special device to eliminate uremic toxins and regulate the body's electrolyte fluids. [8] In fact, if the treatment is not carried out properly, it can increase the risk of complications. Anemia is caused by a decreased in the level of erythropoietin produced by the kidneys, with is followed by decreased GFR.7 Some laboratory parameters, including albumin and hemoglobin levels, can be used to evaluate the progression of CKD, predicting its clinical outcomes, evaluating response to treatment, as well as predicting of the prognosis. [9] Wong et al. showed that patients with lower mean serum albumin levels on their first Kt/V method to assess adequacy of dialysis i.e. Kt/V < presentation for dialysis had an increased risk for early death. Serum albumin, serum protein, serum cholesterol and total leukocyte count are predictors of the nutritional status of dialysis patients. Low serum albumin is an important predictor of malnutrition which shows increased morbidity and mortality of dialysis patients. [10-12] Serum albumin is used because of easy availability and a strong association with outcome, especially in ESRD patients. Patients who start dialysis at a very advanced stage (lower level of GFR) are more likely to have hypoalbuminemia because serum albumin is inversely proportional to GFR and directly proportional to hemoglobin level.

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

Materials and Methods

A retrospective cohort study was conducted in the Department of General Medicine, IGIMS, Patna, Bihar, India for the period of six months The inclusion criteria were CKD patients aged ≥19-year-old who had undergone routine hemodialysis at our hospital. There were 100 patients enrolled in this study. Patients aged <19-year-old who were undergoing hemodialysis for the first time, patients with diagnosis of acute kidney injury, and patients whose initial laboratory data were not recorded in medical records were excluded in this study. This study was conducted in accordance with the tenets of the declaration of Helsinki.

Data Collection and Statistical Analysis

Demographic and clinical data were retrieved from hospital medical records. Data included gender, age, etiology of CKD, vascular access of hemodialysis, and prevalence of anemia and hypoalbuminemia. All enrolled patients were divided into subgroups according to mortality outcome of patients. The numerical data were expressed as means and standard deviations. The categorical data were presented as a number and percentage. The statistical analysis was made using chi- square tests. All p values were 2-sided, and the significance level was set at 0.05. Analysis was performed using commercially available software (SPSS version 22.0).

Results

Table 1: Characteristics of patients undergoing routine hemodialysis

Characteristics	N (%)
Gender	
Male	55 (55)
Female	45 (45)
Age	
Adult	65 (65)
Elderly (>60-year-old)	35 (35)
Etiology of CKD	
Diabetic nephropathy	43 (43)
Hypertensive renal disease	30 (30)
Obstructive nephropathy	16 (16)
Others	11 (11)
Hemodialysis access	
Femoral	7 (7)
AV shunt	2 (2)
Subclavian vein catheter	81 (81)
Internal jugular vein catheter	10 (10)
Anemia	
Yes (Hemoglobin <10 g/dl)	68 (68)
No (Hemoglobin ≥10 g/dl)	32 (32)
Hypoalbuminemia	
Yes (Albumin <3.5 g/dl)	70 (70)

No (Albumin ≥3.5 g/dl)	30 (30)
Laboratorium value	
Hemoglobin (g/dl)	9.145±2.24
Albumin serum (g/dl)	3.27±0.63
Outcome	
Alive	72 (72)
Dead	28 (28)

Out of 100 patients, 55% of patients were male and 45% were female. The majority of patients were adults (65%) and elderly (35%). The etiology of CKD included the following: diabetic nephropathy (43%), hypertensive kidney disease (30%), obstructive nephropathy (16%) and others (11%). Regarding vascular access at dialysis initiation, 81% were induced through subclavian vein catheter, 7% through internal jugular vein catheter, 10% through femoral access, and 2% through arteriovenous fistula. At dialysis initiation, 68% of patients had anemia, and 70% of patients had hypoalbuminemia. The mean hemoglobin level was 9.145±2.24 g/dl, while the mean albumin serum level was of 3.27±0.63 g/dl. During the dialysis treatment, 28 patients (28%) died.

Table 2: Association of anemia and hypoalbuminemia with mortality

Parameters	Outcome		P value
	Alive (%)	Dead (%)	
Anemia			
Yes	45 (45)	21 (21)	0.180
No	27 (27)	7 (7)	
Hypoalbuminemia			
Yes	48 (48)	22 (22)	0.340
No	24 (24)	6 (6)	

The majority of patients had anemia and hypoalbuminemia. The bivariate analysis showed that anemia (p value=0.180), and hypoalbuminemia (p value=0.340) were not statistically significant associated with mortality among patients undergoing routine HD.

Discussion

Chronic kidney disease (CKD) is one of the most important contributors of morbidity and mortality of non- communicable disease in the world. The global burden of disease study reported that there were 697.5 million cases of CKD worldwide, and this number increased 2.5 times compared to previous year. [13,14] The progressivity of CKD due to non-optimal management is correlated with various medical complications, including hypertension, cardiovascular disease, anemia, hypoalbuminemia, bone disorders, fluid retention, acid-base disorders, electrolyte disorders, and others. This burden will affect the quality of life of CKD patients. [15] Anemia and hypoalbuminemia are reported to be significant predictive factors for mortality in the first 3 months of hemodialysis. [16]

Several factors are associated with increased CKD progression in men compared to women, such as a higher risk of causing diabetic nephropathy, hypertension, hyperglycemia, albuminuria, dyslipidemia, an increased body mass index, lifestyle factors, kidney structure, and sex hormones. [17] Out of 100 patients, 55% of patients were male and 45% were female. The majority of patients were adults (65%) and elderly (35%). The etiology of CKD included the following: diabetic nephropathy (43%), hypertensive kidney disease (30%), obstructive nephropathy (16%) and others (11%). Regarding vascular access at dialysis initiation, 81% were induced through subclavian vein catheter, 7% through internal jugular vein catheter, 10% through femoral access, and 2% through arteriovenous fistula. Several studies observed that more than twofold increase in the risk for death and hospitalization in the first 90 days of dialysis therapy, where the most substantial risk occurred in the first 2 weeks. Overall, these first weeks of hemodialysis required close observation, because dialysis patients appeared most vulnerable during this time period. [18] The progressivity of CKD was associated with several clinical conditions which contribute to high morbidity and mortality; including anemia and hypoalbuminemia. [19]

At dialysis initiation, 68% of patients had anemia, and 70% of patients had hypoalbuminemia. The mean hemoglobin level was 9.145±2.24 g/dl, while the mean albumin serum level was of 3.27±0.63 g/dl. During the dialysis treatment, 28 patients (28%) died. The majority of patients had anemia and hypoalbuminemia. The bivariate analysis showed that anemia (p value=0.180), and hypoalbuminemia (p value=0.340) were not statistically significant associated with mortality among patients undergoing routine HD. Anemia is inevitable condition found in CKD patients. This

condition causes increase in mortality and morbidity, low physical ability and quality of life, as well as adding higher hospital care cost and longer hospital stay.[20] Various causes can lead to anemia in CKD patients, including reduced erythrocyte age, uremic toxic effects, reduced production of erythropoetin, and iron deficiency. [21-23] Umami et al reported that moderate and severe anemia (Hemoglobin <8 g/dl) were significant predictors of mortality in the first three months of hemodialysis.16 In our study, our findings differed from other studies. Our study showed that anemia was not associated with mortality of CKD patients undergoing routine HD. In contrast, study by Shrestha et al in CKD patients on regular HD showed that anemia was correlated with mortality. [24] Karaboyas et al reported that CKD patients with lower hemoglobin level was associated with a higher mortality rate in months after HD initiation, hence management of anemia before the start of dialysis improves survival after HD start, although there are many possible explanations for these findings. [25]

In the HEMO study, an increase in serum albumin reduced the risk of mortality for more than 6 months of follow-up in patients with albumin. [26] Similarly, Bradbury et al also mentioned that hypoalbuminemia increased the mortality risk in the first 120 days after the initiation of HD. [27] In our study, hypoalbuminemia was not statistically associated with mortality among dialysis patients. This could be because we only asses the initial albumin level when patients start the hemodialysis, not the average albumin level during the treatment.

Conclusion

Out of the total patients who died, most of them died in the first 3 months since the initiation of hemodialysis. The mortality rate was higher in patients with anemia and hypoalbuminemia. Although our study concluded anemia and hypoalbuminemia are not statistically associated with mortality outcome of CKD patients, anemia and hypoalbuminemia may still have prognostic importance for CKD patients undergoing routine HD. Further studies with larger size of cohort are required to address the association of anemia and hypoalbuminaemia with mortality in routine HD patients.

References

1. US Renal Data System. USRDS 1998 Annual Data Report. The National Institute of Health. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases; 1998.
2. Mailloux LU, Napoutano B, Bellucci AC, Mossey RT, Vernace MA, Wilkes BM. The impact of co-morbid risk factors at the start of dialysis upon the survival of ESRD patients. ASAIO journal. 1996 May 1;42(3): 164-9.
3. Parker III TF, Husni L, Huang W, Lew N, Lowrie EG, Associates DN. Survival of hemodialysis patients in the United States is improved with a greater quantity of dialysis. American journal of kidney diseases. 1994 May 1;23(5):670-80.
4. Leavey SF, Strawderman RL, Jones CA, Port FK, Held PJ. Simple nutritional indicators as independent predictors of mortality in hemodialysis patients. American Journal of Kidney Diseases. 1998 Jun 1;31(6):997-1006.
5. Held PJ, Port FK, Wolfe RA, Stannard DC, Carroll CE, Daugirdas JT, Bloembergen WE, Greer JW, Hakim RM. The dose of hemodialysis and patient mortality. Kidney international. 1996 Aug 1;50(2):550-6.
6. Ma JZ, Ebben J, Xia H, Collins AJ. Hematocrit level and associated mortality in hemodialysis patients. Journal of the American Society of Nephrology. 1999 Mar 1;10(3):610-9.
7. Kidney Disease Improving Global Outcomes (KDIGO). Clinical practice guideline for the evaluation and management of chronic kidney disease. Journal of the International Society of Nephrology. 2013;3(1):5.
8. Alisa F, Wulandari C. Faktor-faktor yang berhubungan dengan kepatuhan pasien penyakit ginjal kronik (pgk) yang menjalani hemodialisa di RSUP dr. M. Djamil padang. Jurnal kesehatan mercusuar. 2019 Dec 30;2(2).
9. Tangri N, Inker LA, Hiebert B, Wong J, Naimark D, Kent D, Levey AS. A dynamic predictive model for progression of CKD. American Journal of Kidney Diseases. 2017 Apr 1;69(4):514-20.
10. Wong CS, Hingorani S, Gillen DL, Sherrard DJ, Watkins SL, Brandt JR, Ball A, Stehman-Breen CO. Hypoalbuminemia and risk of death in pediatric patients with end-stage renal disease. Kidney international. 2002 Feb 1;61 (2):630-7.
11. Pifer TB, Mccullough KP, Port FK, Goodkin DA, Maroni BJ, Held PJ, Young EW. Mortality risk in hemodialysis patients and changes in nutritional indicators: DOPPS. Kidney international. 2002 Dec 1;62(6):2238-45.
12. Iseki K, Miyasato F, Tokuyama K, Nishime K, Uehara H, Shiohira Y, Sunagawa H, Yoshihara K, Yoshi S, Toma S, Kowatari T. Low diastolic blood pressure, hypoalbuminemia, and risk of death in a cohort of chronic hemodialysis patients. Kidney international. 1997 Apr 1;51(4):1212-7.
13. Bikbov B, Purcell CA, Levey AS, Smith M, Abdoli A, Abebe M, Adebayo OM, Afarideh M, Agarwal SK, Agudelo-Botero M, Ahmadian E. Global, regional, and national

burden of chronic kidney disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The lancet. 2020 Feb 29; 395(10225):709-33.
14. Xie Y, Bowe B, Mokdad AH, Xian H, Yan Y, Li T, Maddukuri G, Tsai CY, Floyd T, Al-Aly Z. Analysis of the Global Burden of Disease study highlights the global, regional, and national trends of chronic kidney disease epidemiology from 1990 to 2016. Kidney international. 2018 Sep 1;94(3):567-81.
15. Bello AK, Alrukhaimi M, Ashuntantang GE, Basnet S, Rotter RC, Douthat WG, Kazancioglu R, Köttgen A, Nangaku M, Powe NR, White SL. Complications of chronic kidney disease: current state, knowledge gaps, and strategy for action. Kidney international supplements. 2017 Oct 1;7(2):122-9.
16. Umami V, Lydia A, Nainggolan G, Setiati S. Pengembangan model prediksi mortalitas 3 bulan pertama pada pasien penyakit ginjal kronik yang menjalani hemodialisis. Jurnal Penyakit Dalam Indonesia. 2015 Oct 1;2(3).
17. Major RW, Cheng MR, Grant RA, Shantikumar S, Xu G, Oozeerally I, Brunskill NJ, Gray LJ. Cardiovascular disease risk factors in chronic kidney disease: A systematic review and meta-analysis. PloS one. 2018 Mar 21;13(3):e0192895.
18. Chan KE, Maddux FW, Tolkoff-Rubin N, Karumanchi SA, Thadhani R, Hakim RM. Early outcomes among those initiating chronic dialysis in the United States. Clin J Am Soc Nephrol. 2011;6(11): 2642-9.
19. Bello AK, Alrukhaimi M, Ashuntantang GE, Basnet S, Rotter RC, Douthat WG, Kazancioglu R, Köttgen A, Nangaku M, Powe NR, White SL. Complications of chronic kidney disease: current state, knowledge gaps, and strategy for action. Kidney international supplements. 2017 Oct 1;7(2):122-9.
20. Kdoqi. Kdoqi Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease. Am J Kidney Dis. 2006; 47(3):S11-145.
21. Denny SD, Kuchibhatla MN, Cohen HJ. Impact of anemia on mortality, cognition, and function in community-dwelling elderly. Am J Med. 2006; 119(4):327-34.
22. Madore F, Lowrie EG, Brugnara C, Lew NL, Lazarus JM, Bridges K, et al. Anemia in hemodialysis patients: variables affecting this outcome predictor. J Am Soc Nephrol. 1997; 8(12):1921-9.
23. Shrestha T, Bhusal L, Neupane R, Ghimire R, Prasad P. Risk factors associated with mortality among chronic kidney disease patients on regular hemodialysis presenting in emergency services. J Biomed Res Environ Sci. 2021;2(1):1-7.
24. Shrestha T, Bhusal L, Neupane R, Ghimire R, Prasad P. Risk factors associated with mortality among chronic kidney disease patients on regular hemodialysis presenting in emergency services. J Biomed Res Environ Sci. 2021;2(1):1-7.
25. Karaboyas A, Morgenstern H, Waechter S, Fleischer NL, Vanholder R, Jacobson SH, et al. Low hemoglobin at hemodialysis initiation: An international study of anemia management and mortality in the early dialysis period. Clin Kidney J. 2019;5;13(3):425-33.
26. Dwyer JT, Larive B, Leung J, Rocco MV, Greene T, Burrowes J, et al. Are nutritional status indicators associated with mortality in the Hemodialysis (HEMO) Study? Kidney Int. 2005;68(4):1766-76.
27. Bradbury BD, Fissell RB, Albert JM, Anthony MS, Critchlow CW, Pisoni RL, 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.