ORIGINAL ARTICLE

Intisari Sains Medis 2020, Volume 11, Number 2: 466-469
P-ISSN: 2503-3638, E-ISSN: 2089-9084

Published by DiscoverSys

Analysis of serum albumin levels in pre and post hemodialysis among Chronic Renal Failure (CRF) patients at Dr. Wahidin Sudirohusodo Hospital, Makassar, Indonesia

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ABSTRACT

Background: Chronic renal failure (CRF) is a clinical syndrome caused by a chronic decrease and gradual progression in kidney function. One of the complications of CRF can cause hypoalbuminemia. Hemodialysis can also cause hypoalbuminemia associated with inflammation and malnutrition due to loss of protein during dialysis. This study aims to analyze the albumin levels in pre and post hemodialysis CRF patients in Dr. Wahidin Sudirohusodo Hospital, Makassar.

Methods: A retrospective study with cross sectional study design using secondary data obtained from the medical record was conducted among 50 patients at Dr. Wahidin Sudirohusodo Hospital, Makassar. Pre and post hemodialysis serum albumin levels of CRF patients from the Medical Record Installation were collected during September 2017 – 2018 period. Variables assessed in this study were gender, age, albumin levels, and the comparison of albumin levels based on gender. Data were analyzed using SPSS version 22 for Windows.

Results: There were 52.0% male and 48.0% of female patients in this study. Most of the respondents were age 40-49 years old interval (30.0%). There was no significant difference in albumin levels between pre (3.07±0.63 g/dL) and post (3.05±0.54 g/dL) HD patients (p=0.665). Also, There was no significant difference in albumin levels in pre and post HD patients between male (p=0.434) and female (p=0.778).

Conclusion: There were no significant differences between serum albumin levels pre and post hemodialysis in patients with CRF as well as based on gender.

Keywords: Albumin, chronic renal failure, hemodialysis

Cite This Article: Tanan, M.K., Mangarengi, F., Mutmainnah. 2020. Analysis of serum albumin levels in pre and post hemodialysis among Chronic Renal Failure (CRF) patients at Dr. Wahidin Sudirohusodo Hospital, Makassar, Indonesia. *Intisari Sains Medis* 11(2): 466-469. DOI: 10.15562/ism.v11i2.599

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Received: 2019-09-01
Accepted: 2020-09-07
Published: 2020-08-01

INTRODUCTION

Chronic Renal Failure (CRF) is a clinical syndrome caused by a persistent decrease and gradual progression in kidney function.[1] It cannot be recovered so that the body is unable to maintain metabolism and fails to maintain fluid and electrolyte balance which increases urea.[1] This occurs when the Glomerular Filtration Rate (GFR) is less than 60 ml/min/1,73 m^2.[1,2]

On 2012, the amount of CRF in the world was more than 500 million people and 1.5 million peoples those who had to live depends on hemodialysis.[3] In other developing countries, this incident is estimated at approximately 40 - 60 cases per one million populations per year.[3,4] In Indonesia, CRF is a big problem. Prevalence increases by 10% per year. Data from the Indonesian Nephrology Association (PERNEFRI) in 2011, it estimated that from 70.000 patients with chronic renal failure in Indonesia, there are 4.000 – 5.000 patients who detected terminal stage CRF and underwent hemodialysis.[5,6]

Hemodialysis (HD) is one of TPG that aims to remove protein metabolism residual or correct the disturbance of water and electrolyte balance, between patient blood and dialysate through a semi-permeable membrane that acts as a dialyzer.[7] This process is entirely sufficient for maintaining the patient's body homeostasis. Also, HD action can cause hypoalbuminemia associated with inflammation and malnutrition in hemodialysis patients. Besides, HD action can cause protein loss when dialysis is done.[8]

CRF occurs protein losses through urine and it can cause a decrease in serum albumin or hypoalbuminemia levels, the release of albumin through urine is due to increased permeability in the glomerulus which causes proteins to pass into the glomerular filtrate.[9]

Albumin (69 kDa) is the main protein in human plasma and it creates total plasma protein around 60%.[10] About 40% of albumin exist in plasma, and the remaining 60% is in extracellular space. Albumin plays a role in helping maintain colloidal blood osmotic pressure (75-80% plasma osmotic pressure), as a transport protein of various substances including bilirubin, enzymes, hormones, drugs. Albumin synthesis only occurs in liver cells

with a rate of around 15 g/day.[10] albumin has a half-life of 21 days with a degradation rate of about 4% per day. Low serum albumin level is a significant predictor of morbidity and mortality in CRF patients. Every decrease 10 g/dL in serum albumin, the mortality rate increased by 13.7% and morbidity increased by 8.9%. Become hypoalbuminemia if blood albumin levels are less than 3.5 g/dL.[10,11]

A study conducted by Pupim LB *et al.* suggested that CRF patients who underwent hemodialysis experienced an albumin decrease.[12] This is related to the malnutrition experienced by patients while undergoing hemodialysis therapy. Albumin is a biochemical marker commonly used to determine the nutritional status of hemodialysis patients.[12]

Based on the mentioned above, this study aims to evaluate the difference of serum albumin levels in pre and post hemodialysis Chronic Renal Failure (CRF) patient at Dr. RSUP Wahidin Sudirohusodo, Makassar, Indonesia.

METHODS

This study was a retrospective study with a cross-sectional study design using secondary data obtained from medical record data at the Medical Record Installation at RSUP Dr. Wahidin Sudirohusodo from September 2017 - 2018 among 50 patients. The sample was obtained from the medical record data of CRF patients who underwent hemodialysis and examination of serum albumin levels in pre and post hemodialysis at RSUP Dr. Wahidin Sudirohusodo. The inclusion criteria were patients diagnosed with CRF who underwent hemodialysis for the first time and examination of serum albumin levels in pre and post hemodialysis. The exclusion criteria were incomplete patient data.

Variables assessed in this study include gender (%), age (%), albumin levels (g/d:), and the comparison of albumin levels (g/dL) based on gender. All of the data were statistically analyzed using SPSS version 22 with a *paired t-test* to compare albumin levels in *pre* and *post* hemodialysis. The test results are significant if $p < 0.05$. Data are presented in tables and figures.

RESULT

In Table 1, there were 50 patients with CRF who underwent hemodialysis included in this study. Most of respondents were age 40-49 years old (30.0%), followed by ≥60 (28.0%), 50-59 years (22.0%), 30-39 years (10.0%), 20-29 years (8.0%), and <20 years (2.0%) old (Table 1). Based on gender, there were 26 males (52%) and 24 females (48%) recruited in this study (Table 1).

The comparison of albumin levels in pre and post HD showed no significant differences (p=0.665) (Table 2). In pre HD it was found that serum albumin level was 3.07±0.63 g/dL. The lowest serum albumin level was 1.9 g/dL and the highest was 4.4 g/dL. In post HD, it was found that the mean serum albumin level was 3.05±0.54 g/dL. The lowest serum albumin level was 2.2 g/dL and the highest was 4.3 g/dL (Table 2)

In Table 3, the comparison of albumin levels according to gender found that the mean of albumin level in pre HD was 3.17±0.60 g/dL and post HD was 3.10±0.54 g/dL among male (p = 0.434). In women, the mean of albumin level in *pre* HD was

Table 1 Baseline Characteristic of Respondents

Variable		Amount (n=50)	Percentage (%)
Gender	Male	26	52.0
	Female	24	48.0
Age Range (Years)	<20	1	2.0
	20-29	4	8.0
	30-39	5	10.0
	40-49	15	30.0
	50-59	11	22.0
	≥60	14	28.0

Table 2 The comparison of albumin levels in *pre* and *post* HD

Variables	n	Mean	SD	Min-Max	p
Pre HD	50	3.07	0.63	1.9-4.4	0.665
Post HD	50	3.05	0.54	2.2-4.3	

SD: Standard Deviation; p: *Paired-t test* was considered statistically significant if less than 0.05

Table 3 **The comparison of albumin levels in *pre* and *post* HD by gender**

Gender	Variables	n	Mean	SD	p-value*
Male	Pre HD	26	3,17	0,60	0,434
Female	Post HD	26	3,10	0,54	0,778
	Pre HD	24	2,97	0,66	
	Post HD	24	2,99	0,55	

SD: Standard Deviation; p: *Paired-t test* was considered statistically significant if less than 0.05

2.97±0.66 g/dL and *post* HD was 2.99±0.55 g/dL (p = 0.778) (Table 3). The *Paired-t test* shows no significant difference in albumin levels in pre and post HD for both gender (p>0.05) (Table 3).

DISCUSSION

Hypoalbuminemia conditions were obtained both *pre* and *post* hemodialysis with a mean of 3.07 g/dL and 3.05 g/dL, respectively.[9] It illustrates mild hypoalbuminemia status, both *pre* and *post* hemodialysis. Hypoalbuminemia is divided into 3 (three) types based on low levels of albumin in the blood. Mild hypoalbuminemia has an albumin level of 3.0-3.4 g/dL, whereas moderate hypoalbuminemia has 2.5-3.0 g/dL, and severe hypoalbuminemia has ≤ 2.5 g/dL.[13] This is consistent with a study conducted by Pupim LB *et al.* which states that patients with chronic renal failure undergoing hemodialysis experience a condition of hypoalbuminemia.[9,12]

There was a decrease of albumin level in *post* hemodialysis chronic renal failure patient of 0.02 g/dL but with the Paired-t test on albumin level in *pre* and *post* hemodialysis no significant difference. This condition illustrates that hemodialysis does not affect the status of patient's hypoalbuminemia with chronic renal failure. This is likely related to the long half-life of albumin, which is 21 days. In this study, the distance between albumin level control in *pre* and *post* hemodialysis was done less than 21 days. According to Arinta et al. states that albumin levels tend to increase after HD action for > 1 year with a mean of albumin level of 3.69 g/dL. In contrast, in patients with HD for < 1 year, a mean value of albumin level is lower of 3.20 g/dL.[14] A study conducted by Majid RA in RSUD Dr Moewardi was also found albumin levels in CRF patients who not yet undergone HD was 3.37 g/dL while they who had experienced HD was 3.79 g/dL.[15]

In this study, albumin levels in *pre* and *post* HD by gender, both men and women did not differ significantly (p > 0.05). Serum albumin levels depend on the synthesis rate, the amount secreted by the liver, the distribution of body fluids and the degree of degradation. Hypoalbuminemia results from interference with one or more of these processes. Hypoalbuminemia is a complication commonly found in CRF.[9] This change in albumin concentration is due to a decrease in synthesis, increased metabolism and changes in the volume of its distribution. Hemodialysis is said to cause hypoalbuminemia because it reduces albumin synthesis. Albumin synthesis itself is influenced by nutritional factors and the presence of inflammation.[10] In CRF, there will be several processes that cause malnutrition. In CRF, patients can experience gastritis and ulceration in the digestive tract as a complication of chronic kidney disease. This causes patients to lack nutrition. In addition, in CRF patients, found micro-inflammation completely. It increases in the use of amino acids to make cytokines and other pro-inflammatory substances. Besides inflammation also plays a role in suppressing albumin synthesis.[16] In hemodialysis, nutritional deficiencies and inflammation still occur.[16] HD patients generally experience nausea. This symptom can be caused by post-HD hypotension, excess fluid intake between two HD therapies, problems related to dry weight, allergic reactions, infections, hypertension drugs, dialysis disequilibrium, anaemia and the use of acetate in HD. In addition, HD also causes an inflammatory process.[11,17]

Albumin has a critical role in the human body. Certainly, hypoalbuminemia has an adverse impact. Hypoalbuminemia is a marker of underlying pathological processes such as malnutrition and inflammation.[10,16] Therefore, albumin levels should continue to be monitored in managing HD patients.

CONCLUSION

In this study, we can conclude that there is hypoalbuminemia in both *pre* and *post* hemodialysis. There is a significant decrease in serum albumin levels in *pre* and *post* hemodialysis in chronic renal failure patient. It is recommended for clinicians to provide adequate protein nutrition for chronic renal failure patients post hemodialysis to overcome hypoalbuminemia condition.

CONFLICT OF INTEREST

There was no competing interest regarding the manuscript.

ETHICAL CONSIDERATION

The ethical feasibility agreement was obtained from the Health Research Ethics Commission of

the Faculty of Medicine, Universitas Hasanuddin, Dr. Wahidin Sudirohusodo, Makassar, Indonesia.

FUNDING

The authors are responsible for the funding of the study without the involvement of grant, scholarship, or any other resources of funding.

AUTHOR CONTRIBUTION

All of the authors are responsible for the study from the conceptual framework, data gathering, data analysis, until interpreting the results of the study through publication.

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