Original Article

The Administration of Intradialytic Parenteral Nutrition Does Not Affect the Anemia Status of Chronic Kidney Disease Patients Undergoing Hemodialysis

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ABSTRACT

Background: Hemodialysis (HD) patients are susceptible to malnutrition, and there is a close relationship between malnutrition and the incidence of anemia. Parenteral nutrition plays a role in treating malnutrition.
Objective: This study aims to determine the effect of parenteral nutrition on anemia in HD patients.
Methods: Quasi-experimental research which is part of the nutritional research tree at the Hemodialysis Unit of RSUP Dr. Soetomo Surabaya for 3 months. A total of 45 malnourished CKD patients (SGA B & C) undergoing routine HD were included in this study (n=26 received regular diet & education, n=17 received regular diet, education and intradialytic parenteral nutrition, and n=2 dropped out of education due to blood transfusion). Measurements of body mass index (BMI), hemoglobin (Hb), serum iron (SI), and total iron binding capacity (TIBC) were carried out before and 8 weeks after therapy. Between groups used the Mann-Whitney test, while pre and post used the Wilcoxon matched-pairs sign rank test.
Results: The treatment group was older than the control group. There was no difference in duration of HD between groups. Intradialytic parenteral nutrition had no effect on BMI (24.71±3.939 vs 24.71±4.026; p=0.3802), Hb (9.746±1.309 vs 9.162±1.960; p= 0.3525), SI (62.33±34.74 vs. 53.78±24.89; p=0.3594), and TIBC (242.8±119.0 vs. 197.3±43, 65; p=0.4258).
Conclusion: In HD patients, intradialytic parenteral nutrition for 8 weeks did not affect Hb, SI and TIBC levels. Long-term observations with larger samples are needed to confirm these findings.
Keywords: chronic kidney disease, anemia, parenteral nutrition, hemodialysis, nephrology.

Introduction

Anemia in Chronic Kidney Disease (CKD) is one of the complications that increases the risk of morbidity and mortality. The severity of anemia in CKD exacerbates particularly when patients progress to end-stage renal disease requiring kidney replacement therapy such as dialysis. The causes of anemia in CKD patients undergoing dialysis are multifactorial, including blood loss during medical procedures (dialysis, blood sampling), erythropoietin hormone deficiency, iron deficiency, inflammation, and malnutrition.[1] CKD patients undergoing hemodialysis are highly susceptible to malnutrition due to inadequate protein and calorie intake.[2] Chronic malnutrition, as we know, also exacerbates inflammation. If this continues unabated, it creates a vicious cycle where patients repeatedly undergo blood transfusions, which also carry a risk of transfusion-related infections.[3]

Nutritional improvement in CKD patients undergoing hemodialysis is crucial to break the vicious cycle and is expected to mitigate inflammation and improve nutritional status, thereby gradually improving anemia conditions.[4]

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The most fundamental approach to nutritional improvement in CKD patients undergoing hemodialysis involves diet and nutrition education by physicians and dietitians, although it takes time to achieve optimal results and requires the involvement of patients and their families.[5] Another method of nutritional improvement is through the use of parenteral nutrition during hemodialysis, especially for those who cannot tolerate oral or enteral intake due to symptoms such as nausea, vomiting, or anorexia. Previous research has shown that parenteral nutrition improves nutrition, albumin levels, BMI, and transferrin status.[3,6,7] In this study, the researchers aimed to investigate the relationship between intradialytic parenteral nutrition administration and the anemia status in CKD patients undergoing hemodialysis.

Methods

Design and participants

The research sample consisted of all CKD patients aged 21 to 60 years undergoing long-term routine hemodialysis at the hemodialysis unit of Dr. Soetomo Hospital, Surabaya. Inclusion criteria included patients with SGA category B and C scores and serum albumin levels < 3.8 g/L. Exclusion criteria encompassed unstable CKD patients, history of allergies, chronic infections and sepsis, edema, and malignancies. All research samples received the same regular diet and nutrition education. Patients receiving treatment had intradialytic parenteral nutrition administered during their scheduled dialysis sessions. The composition of the parenteral nutrition included a solution of crystalline amino acids 8.5% 500 ml (42.5 grams) with 50% dextrose 250 ml (125 grams) that could be supplemented with lipid emulsion 20% 250 ml (50 grams), electrolytes, and vitamins as needed. The parenteral nutrition was infused through a venous drip chamber during dialysis, initiated 30 minutes after HD commencement and continued throughout HD. In this study, we used a solution containing 25 grams of dextrose (250 ml D10%) and 28.8 grams of amino acids. The collected data included age, gender, duration of dialysis, body mass index (BMI), hemoglobin levels, serum iron (SI), and total iron-binding capacity (TIBC).

Statistical analysis

The data were collected and analyzed using SPSS version 25. Descriptive data included age, gender (male and female), and duration of hemodialysis. Subsequently, the observations of CKD patients undergoing hemodialysis, both those receiving intradialytic parenteral nutrition and those who did not, will be analyzed using the Mann-Whitney test (comparison between test groups) and the Wilcoxon matched-pairs signed-rank test (pre- vs. post-intervention).

Results

A total of 45 CKD patients with malnutrition (SGA B & C) undergoing routine hemodialysis at the Hemodialysis Unit of Dr. Soetomo Hospital, Surabaya, met the predefined inclusion criteria. Subsequently, 26 patients received regular diet and education (i.e., the control group), 17 patients received regular diet, education, and intradialytic parenteral nutrition (i.e., the treatment group), while 2 patients were excluded from the study due to requiring blood transfusions during the study period. Measurements of BMI, Hb levels, serum iron (SI), and TIBC were conducted on all samples in both test groups before and 8 weeks after the administration of intradialytic parenteral nutrition. The baseline data from both test groups showed that the treatment group was older than the control group (51.41±6.083 vs. 44.46± 9.118 years, p=0.0124), and there were more male patients than females (n=15/11 in the control group and n=9/8 in the treatment group). In the control group, no patients had diabetes mellitus (0%), while 15 out of 17 patients in the treatment group had diabetes mellitus (88%). In the control group, 22 out of 26 patients had hypertension (85%), while 8 out of 17 patients in the treatment group had hypertension (47%). There was no difference in the duration of hemodialysis between the two study groups (47.69±30.68 and 36.82±28.11 months,

respectively, in the control and treatment groups; p=0.2318).

Examination of vital signs in both study groups did not show statistically significant differences. For instance, the mean pulse rate of patients in the control and treatment groups were 87.38±4.392 and 87.47±4.064 beats/minute, respectively (p=0.9361). Similarly, systolic and diastolic blood pressure in both groups also did not exhibit significant differences (mean systolic: 143.8±14.99 vs. 145.3±14.19 mmHg, p=0.8205; median diastolic: 85.00 [IQR 77.50-90.00] vs. 90.00 [IQR 80.00-90.00], p=0.5317). The mean baseline BMI of patients in the control and treatment groups were 22.73±3.655 and 24.71±3.939, respectively (p=0.0976). Initial Hb levels also did not differ significantly between the control (9.227±1.654) and treatment (9.435±1.572) groups with a p-value of 0.6986. Similarly, the comparison of median SI at the beginning of the study did not show statistically significant differences with a median of 57.50 [IQR 43.25-81.25] in the control group and 50.00 [IQR 39.00-74.00] in the treatment group (p=0.3851). Likewise, the comparison of median TIBC at the beginning of the study did not show statistically significant differences with a median of 191.5 [IQR 147.8- 255.8] in the control group and 226.0 [IQR 180.0-290.5] in the treatment group (p=0.1757).

The observation results over 8 weeks in both study groups indicated that the administration of intradialytic parenteral nutrition did not affect BMI (24.71±3.939 before vs. 24.71±4.026 after; n=17; p=0.3802), Hb levels (9.746±1.309 before vs. 9.162±1.960 after; n=13; p=0.3525), serum iron (SI) levels (62.33±34.74 before vs. 53.78±24.89 after; n=9; p=0.3594), and total iron-binding capacity (TIBC) (242.8±119.0 before vs. 197.3±43.65 after; n=9; p=0.4258).

Discussion

In this study, the treatment group was older compared to the control group, and there Additionally, researchers were unable to observe the patients' food intake at home.[6,10] were more male participants than females in both groups. Additionally, there was no difference in the duration of dialysis between the two groups. Moreover, physical examinations did not show any differences between the two groups. This finding is consistent with previous research conducted by Cano *et al.*[6]

In the treatment group, after the administration of intradialytic parenteral nutrition for 8 weeks, there was no significant increase in BMI. This finding is consistent with studies by Czekalski and Cano, which found no increase in BMI following intradialytic parenteral nutrition.[6,8] However, this contrasts with the study by Kittiskulnam, which reported an improvement in BMI after 3 months of intradialytic parenteral nutrition.[7] BMI in hemodialysis patients is influenced by various factors such as dietary intake, uremic condition, physical activity, and fluid accumulation between dialysis sessions.[9] In this study, the physical activity of patients and dietary intake did not differ pre and post-treatment. Additionally, there were no significant clinical symptoms of uremia during the study. The use of parenteral fluids may also vary between research centers.

The hemoglobin levels also did not show significant differences before and after the administration of intradialytic parenteral nutrition for 8 weeks. The hemoglobin values remained around 9. This finding is consistent with the study by Cano.[6] Similarly, there were no significant changes in serum iron (SI) and total iron-binding capacity (TIBC) values before and after the administration of intradialytic parenteral nutrition for 8 weeks. This condition is similar to the findings of the study conducted by Lu & Marsen,[9,10] where there was no improvement in SI and TIBC during the study. Despite all patients receiving monthly erythropoietin therapy in this study, there was still no improvement in hemoglobin levels. All research samples received the same regular diet and education. This could be related to the short duration of the study and possibly the socioeconomic status of the dialysis patients, who may be of lower economic status.

Conclusion

From the results of intradialytic parenteral nutrition administration over 8 weeks, there was no significant effect on Hb, SI, and TIBC levels in CKD patients undergoing hemodialysis. Longer-term observation with a larger sample size is needed to confirm these findings.

Limitations of the Study

This study may not fully reflect the entire population as it was conducted at a single healthcare center with a limited sample size. Additionally, the duration of the study was short, which may have impacted the nutritional improvements, as such improvements typically require more time.

Declarations

Competing interests

The authors declare no conflict of interest.

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Author's Contribution

Idea/concept: DMH, ADPN, AT, W, P. Design: DMH, ADPN, AT, W, P. Control/supervision: DMH, ADPN, AT, W, P. Data collection/processing: DMH, ADPN, AT, W, P. Extraction/Analysis/interpretation: DMH, ADPN, AT, W, P. Literature review: DMH, ADPN, AT, W, P. Writing the article: DMH, ADPN, AT, W, P. Critical review: DMH, ADPN, AT, W, P. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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