

Dietary Management Control Serum Potassium Level in Renal Patients on Dialysis

Suhair Abdalla Khalil Abdalla

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Rationale

Hyperkalaemia is a significant health problem in end stage renal disease (ESRD) patients on hemodialysis (HD). It can lead to arrhythmias and sudden cardiac arrest, and other disorders as well as cardiac problems, and is also associated with increased prevalence of mortality in HD patients. The aim of present study was to evaluate effect of Dietary management and dietetic intervention on serum potassium levels for its management.

Methods

The study was organized big dialysis centers in Khartoum during 6 months. ESRD patients (n=145) on regular HD (two-three times weekly), dialyzed for at least 3 months were included to the study. They were divided into test group (n=83) and control group (n=62). The test group received nutritional counseling and consumed individualized diets (restricted in potassium according to National Kidney Foundation) for a period of 6 months. The control group consumed usual diets. Serum potassium levels were measured at baseline and 2, 4 and 6 months after start of the study.

Results

Serum potassium levels decreased significantly from 5.03 mg/dL at baseline to 4.5, 4.3 and 4.1 mg/dL on 2, 4 and 6 months after the onset of study in the test group. In control group the decrease was mild and insignificant (4.8, 4.8, 4.4 and 4.4 mg/dL, at baseline, 2, 4 and 6 months). Significant difference between groups were apparent in month 4 and 6 ($p < 0.05$).

Conclusions

The study demonstrated that effective nutritional counseling was effective in the control and improvement of serum potassium level in renal patients on HD. Therefore, nutritional counseling by qualified dietitians should be mandatory in renal dialysis units as part of the medical therapy management to reduce the incidence of Hyperkalaemia in HD.

Introduction

Patients with End-Stage Renal Disease (ESRD) on regular Hemo Dialysis (HD) are usually facing elevated levels of serum potassium which can lead

to cause a high risk of developing hyperkalemia. Hyperkalemia is the medical term use to describes a potassium level in the blood that's higher than normal reference ranges of (3.5 to 5.0), and it is defined generally as serum potassium (K^+) concentrations of >5.0 mg/dl. And it contributes significantly to high mortality with renal patients on HD. (1)

Hyperkalaemia is a significant health problem in end stage renal disease (ESRD) patients on hemodialysis (HD). It can lead to arrhythmias, sudden cardiac arrest, as well as causing palpitations and shortness of breath, muscle pain, fatigue, muscle weakness, or numbness during its severe stages, and is also associated with increased prevalence of mortality in HD patients and it is one of the leading cause to death.(2)

The prevalence of hyperkalemia among Chronic Kidney Disease (CKD) patients is mostly higher (3) than in the general population, hyperkalemia reports more than 40-50% in the CKD patients. (4) Common causes of Hyperkalemia include kidney failure uncontrolled diabetes, dehydration, taking A number of medications can also raise serum potassium level such as Non-steroidal anti-inflammatory drugs (NSAIDs), and angiotensin converting enzyme inhibitors. some diuretics, cyclosporine, trimethoprim, beta-blockers, calcium blockers, succinylcholine, digoxin, heparin, and mannitol. (5) (6)

Also excess intake and inadequate of food containing high potassium are the most common causes hyperkalemia in HD patients. Diet rich in potassium can lead to higher serum potassium levels. Therefore dietary management in the form of controlled potassium food intake should be taken by renal patients to control their serum potassium levels as well as to prevent hyperkalemia during dialysis.(7)

National Kidney foundation recommended not exceeding 3 g per day of potassium in diet, to help in control high serum potassium levels and prevent hyperkalemia with HD patients. And world health organization advice on less than 3.9 g/day for renal patients. (8)

Treatment of hyperkalemia is varies (9) depend on the case and causes. Usually medical and dietary

treatment are used to manage the condition. Dietary management used to help in reduce the dietary potassium intake through diet control to achieve a good control to serum potassium levels. (10) , it is recommend the implementation of specialized dietary interventions program as individualized meal planning to help in Improving knowledge and information about the kind of foods high in potassium; educate on foods that are needed for good and healthy nutrition to patients on Kidney diseases; learn about type of foods based on their potassium content, education about the way of cooking (such as boiling) in order to reduce the content of potassium in foods.(11).

The present paper aims to reflect the role of Dietary management in control serum potassium levels and prevention from the risk of Hyperkalaemia in renal patients on HD.

Materials and Methods

Patients and study design

This study is intervention study done to evaluate the effect of dietary management on the serum potassium level with ESRD patients on hemodialysis.

The study conducted in the one of the biggest Hemo dialysis and Transplant Center in Khartoum. full coverage of all ESRD patients on regular hemodialysis and dialyzed at Dr Salma Hemodialysis and Transplant Center were enrolled in the study.

Participants were chosen from the patients who fulfilled the following inclusion criteria : (ESRD patients on regular HD (three times weekly), dialyzed four hours per session, Patients, who dialyzed for at least 3 months, Both genders ,More than 18 years of age, consent given for participation in the study, Absence of active underlying disease (e.g., collagen vascular disease), Absence of active infection (free from infections and inflammations)and Not hospitalized during the month preceding the study).

Among the 156 chronic renal failure patients who were on HD treatment and dialyzed at Dr Salma Hemodialysis and Transplant Center, during the study period, 145 fulfilled the inclusion criteria and were enrolled in this study. The patients were divided into 2 groups: test group (n = 83) and control group (n = 62). After the intervention period, the sample decreased to 134 patients (77 test and 57 control). Some died; others opted for transplant and changed to peritoneal dialysis.

Method of data collection

Data was collected on (baseline), during study period and after intervention. The patients'

medical records were reviewed by the researcher to check the co-morbid conditions and medical history of the participants, to review the presence of any other associated diseases such as DM, HTN, IHD, hepatitis profile, duration of the problem, treatment, duration on dialysis (per months), number of dialysis sessions per week and duration of dialysis in hours. The medical records were reviewed for all participants (test group and control group) at baseline study and at every 2 months for biochemical results.

A questionnaire was used to collect data (on baseline) through direct interviews by the researcher. Each subject was interviewed with a structured questionnaire during their dialysis session. It was used to collect the Demographic characteristic of the sample and some Medical characteristic of the sample.

Nutritional status assessment

Intervention

Eighty-three HD patients who were included in the study as test group received conventional nutritional counseling and individual meal plan to achieve adequate potassium intake. Monitoring was done during 6 months of follow up. The individual meal plan was designed and explained to patient and their families by the following ways:

Educational lecture:

Educational lecture was given exclusively to the test group. It was presented by the researcher to the patients and their families during their dialysis session by using a data-show to educate the patients and their families on the nutritional needs to provide appropriate food with adequate restricted potassium intake to the patients.

Presentation included all the important information needed to be known by ESRD patient on HD. It was concentrated on renal diet with restricted potassium intake and including other enough nutrients needed such as calorie and protein needed, fluids limitation, intake of sodium, potassium and phosphorus in foods, to complete the balance of renal diet. Information was provided in a simple way and was explained by pictures for more understanding.

Pamphlets:

It were prepared and distributed to all intervention group participants after the lecture and all the summary information that was presented was printed in the sheet (general instruction sheet for renal patients on HD) and distributed to the participants.

Suhair Abdalla Khalil Abdalla

King Saud Bin Abdulaziz University, Saudi Arabia

Individualized meal plans:

Meal plan was designed individually to all intervention group participants after analysis of the full information that helped the researcher to conduct the meal plan. The meal plan was based on: patient's economic status, medical history, diet history, like and dislike, chewing and swallowing status, food allergies, blood investigation result, age, weight, height and sex. (Food exchange list was used to help patients for food substitutes if participant unable to follow the meal prescribed according to like and dislike Or socio economic reasons).

After calculation of all nutrients needed by each participant, individual meal plan for the whole week was designed by researcher, typed, organized, color printed and given to participant with full explanation of uses. The meals planned were designed only for intervention patients, whereas control patients continued to receive their usual care.

Biochemical parameters:

Serum biochemical data were obtained for the participants at the Clinical Chemistry Laboratory at Dr Salma Hemodialysis and Transplant Center.

Blood samples were drawn from the patients under fasting conditions just before the beginning of a dialysis session and measured serum potassium at baseline and every two months during intervention period till the end of the study for all participants. The following parameters were determined: serum potassium with normal values ranging from 3.0 to 5.0 g/L,

Medications:

All the participants from both groups (test and control group) took their medications, such as receiving antihypertensive, phosphate binder's erythropoietin, iron medications and supplementation of vitamins B, C, D during the study, which were recommended by their physicians.

Follow up:

Each patient was monitored during three consecutive dialysis sessions during the study period (baseline-2-4-6 months).

Statistical Analysis

All analyses were performed using SPSS statistical software package program (version 17.0 for Windows; SPSS Inc., Chicago, IL, USA). The results are presented as frequencies and percentages for categorical variables and mean [+ or -] standard deviation (SD) were calculated for all continuous variables. For comparison and differences between means data were analyzed using the 't' test and

(χ^2) qui squire test. A 'p' value of less than (<) 0.05 was considered statistically significant.

Results

Demographic characteristic of the study sample

For the demographic characteristic of the study participants, test and control, Males represented a higher percentage than the females. The age group distribution of subject shows that most of the patients (46.3%) were in the active age group of 30 - 45 yrs. (49.4% test and 42.1% control). The majority (31.3%) had higher secondary school education (29.9% test and 33.3 % control), followed by 17.9% university graduates (23.4% test and 10.5% control), the rest were illiterate or with low educational level.

Medical profile of the participants

The medical characteristics of the study participants are shown that 53.7% of the participant had hypertension (61.0% test and 43.9% control), while only 3.0% had diabetes mellitus and hypertension (1.3% test and 5.3% control) and the rest 43.3% did not have any comorbid disease (37.7% test and 50.9% control).

The mean durations of dialysis periods were 57.08 \pm 36.16 months for both groups (61.77 \pm 38.84 test and (50.75 \pm 31.42 control group).

Biochemical evaluation of the study patients

Serum potassium

Figure (1) shows the changes in serum potassium levels in the study before and after the intervention with both studied groups (test and control), the results showed quick control in potassium level during the study in intervention group compared with a little decreased in control group. Study shows that at baseline, there was no significant difference in the biochemical markers (Serum potassium) between the two groups (P = 0.665).

During the intervention period, serum potassium increased in the test group and there was a significant difference in groups, however the increase in potassium was significantly higher when test group was compared with control group during the whole period of the study (P < 0.05). (Figure 1).

The Nutritional status differences according to changes in serum potassium levels in the study during each study period before and after the intervention with both studied groups (test and control) are very clear in (Figure 1). The study shows big differences in controlling of serum potassium level during the study with intervention group compared with mild control with control group.

Suhair Abdalla Khalil Abdalla

King Saud Bin Abdulaziz University, Saudi Arabia

Discussion

Health care providers (specially dietitian and physician) who work in dialysis units, routinely advise patients to restrict potassium intake in their diet due to their kidneys damage (12), which are no longer able to regulate the level of potassium in the blood. Elevated potassium levels can lead to medical emergencies because they are associated with irregular heartbeats, higher dietary potassium intake is associated with increased death risk in long-term hemodialysis patients (13)

National Kidney Foundation (NKF-DOQI) (14) recommended restricted potassium intakes by HD patients to (3 g/day) as the dietary treatment to control the serum potassium levels and prevent.

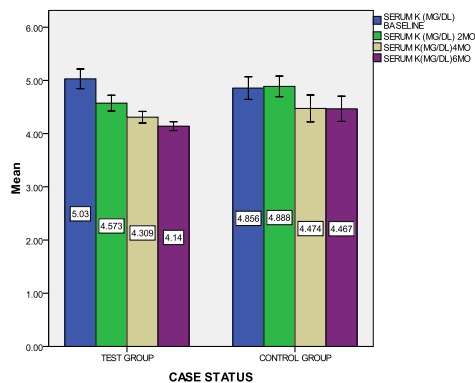


Fig. (1): changes in serum potassium levels in the study patients throughout the study. (n=134)

Hyperkalemia among hemodialysis patients disease needs restricted dietary potassium intake to meet the controlled needs for the prevention and management of elevated serum potassium levels. (15).

In this study the Serum Potassium (mg/dl) was found within the normal range (Potassium with normal values ranging from 3.5 to 5.0 (mg/dl)) in both study groups from base line and till the end of study. The potassium level is quick controlled in patients who followed the individual meal plan compared with controls.

Our study is in contrast with Abu- Almakarem in his study in Saudi Arabia that found most of the study patients were on controlled serum potassium level and only 1.6% of the patients showed serum potassium of ≥ 6 , 32.3% (16). Another study done in Turkey found high prevalence of hyperkalemia (43.5%) in hemodialysis studied patients and it was due to non-restricted potassium intake (17). This is the reason why hyperkalemia is frequently observed among HD patients.

Serum potassium is probably still the most commonly used chemical biomarker in clinical

practice (18) as hyperkalemia is considered to be one of the most high risk factors and a strong predictor of death among the hemodialysis patients. (19) high serum potassium levels are due to high intakes of food containing potassium resulting in elevation of serum potassium (20)

In this study, Serum potassium levels decreased significantly from 5.03 mg/dL at baseline to 4.5, 4.3 and 4.1 mg/dL on 2, 4 and 6 months after the onset of study in the test group. In control group the decrease was mild and insignificant (4.8, 4.8, 4.4 and 4.4 mg/dL, at baseline, 2, 4 and 6 months). Significant difference between groups were apparent in month 4 and 6 ($p < 0.05$), which reflects the high improvement in serum potassium level of HD patients after intervention. After 6 months serum potassium levels controlled highly in the test group but mild in the control one; the difference was highly significant within the test group ($P = 0.000$) and between the test and control groups ($P = 0.000$). This is explained by the reduced intake of potassium by the test group which showed gradual significant drop in the potassium level during the intervention period.

The study showed that proper nutritional counseling by a dietitian to HD patients on the intake of potassium and as individualized meal plan can result in a better nutritional status, control increasing of serum potassium levels and prevent hyperkalemia.

Conclusion

This article highlights the rationale for using the individual meal planning with reduced potassium intake is help in controlling serum potassium level as a marker of nutritional status among HD patients.

The results of this study show that using restricted potassium diet in the form of individual meal plan as a nutritional intervention and educational tool to control the potassium intake to the recommended levels by NKF KDOQI guidelines did prevent from causing high serum potassium levels. This suggests that patients are able to understand and utilize restricted potassium diet to meet their recommended potassium intake and achieve good control in their serum potassium level. Therefore, nutritional counseling by qualified dietitians should be mandatory in renal hemodialysis units as important part of the medical therapy management to control the serum potassium level and prevent from the incidence of hyperkalemia among HD patients.

Suhair Abdalla Khalil Abdalla

King Saud Bin Abdulaziz University, Saudi Arabia

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