

Evaluating of Serum Electrolyte Changes in Chronic Renal Failure Pre and Post Dialysis

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Abstract

Background: The kidney played vital role in the regulation of electrolyte and acid–base balance. With progressive loss of renal function, derangements in electrolytes and acid–base certainly occurred and contribute to worse patient outcomes.

Objective: The aim of the present study is to assess the effect of Hemodialysis (HD) on serum electrolytes levels which compared with healthy control group; also to assess the correlation of serum electrolyte before and after hemodialysis.

Material and Method: The study done on 40 patients (25 men and 15 women) all patients with chronic kidney disease, ages of patients 25 – 65 years. All patients enter the dialysis department in Merjan teaching hospital and matched with 30 well persons as control. Results: study of comparison between patients before and after hemodialysis, significant difference in the level of serum urea and creatinine between pre and post dialysis, and significant effect of Hemodialysis on serum electrolytes particularly serum potassium levels. The pre-hemodialysis K^+ was 4.48 ± 0.83 mmol/L and post-hemodialysis K^+ was 3.69 ± 0.65 mmol/L ($P < 0.001$). The pre-hemodialysis Na^+ was 136.5 ± 4.14 and post - hemodialysis Na^+ was 138.6 ± 4.41 ($P = 0.36$). The pre- hemodialysis Cl^- was 106.12 ± 4.02 and post-hemodialysis Cl^- was 107.12 ± 4.11 ($P = 0.38$ NS).

Conclusion: There is decrease in s. urea besides creatinine level between period before and after hemodialysis. Serum K^+ level decreased after hemodialysis. Although serum sodium and chloride levels not significantly affected after hemodialysis.

Keywords: Chronic renal failure, hemodialysis, serum electrolytes.

Introduction

Chronic renal failure is a worldwide complication, a chief reason of high mortality rate in the developed countries. Patients are at higher risk for cardiovascular disease (CVD) and Hyperkalemia is a usually meet problem in patients with progressive renal disease^[1].

Chronic renal failures induce a slow and progressive

decline of kidney's function. It is usually a consequence of complications from another serious medical condition^[2].

The major causes of CRF included chronic glomerulonephritis, progressive nephritic syndrome, diabetes mellitus, chronic hypertension, polycystic kidney and chronic pyelonephritis^[3].

Dialysis is a process that removes overload fluids and poisonous last part products of metabolism as urea from the plasma and corrects electrolytes balance by dialyzing the patient's blood against fluid that contain no urea which has levels of minerals like potassium and calcium that are similar to their natural concentration in healthy blood^[4].

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Dialysis is based on the standard of diffusion equilibrium. In general dialyzing fluid (Dialysate) contains “Na⁺, K⁺ and HCO₃⁻ in a higher concentration than normal plasma (urea, urates, creatinine, phosphate, sulphate are absent)”. If the plasma K⁺ of patient is above normal, K⁺ diffuse out of the blood across the cellophane tubing and in to the dialyzing fluid. Also, waste products and overload of the substances diffuse in to the dialyzing fluid and removed from the body [5].

Hemodialysis is one of the useful method of treatment of hyperkalemia and uremia, also to approve sodium and serum creatinine levels in renal failure. Severe hyperkalemia occur in 10-19% of hemodialysis patients [6]. Many studies showed that a sudden change and decrease in serum K⁺ causes arrhythmia related patients undergoing dialysis [7].

Hypokalemia also arise in dialysis patients due to the exposure to low K (≤ 2 K) dialysate. Post-dialysis hypokalemia associated with serious cardiac arrhythmias and sudden cardiac deaths. And also they stated that

67% were cardiac deaths [8]. The vulnerability to hypokalemia-triggered cardiovascular trial could be related to the cardiovascular diseases, occurring in a majority of end stage renal disease patients [9].

In dialysis patients, hyponatremia is typically dilution, due to overload water or hypotonic fluid intake. Hypernatremia, when persistent, has been seen in those with impaired thirst mechanism or lack of admittance to water. Dysnatremia in chronic kidney disease (CKD) and end stage renal disease has high mortality rate [10].

The study amid to assess the changes in serum potassium, sodium and chloride in pre and post dialysis patients.

Material and Method

A total of 40 patients were taken for this study. For them (25 males and 15 females) were End stage renal disease (ESRD), aged (25-65) year are admitted to al-dialysis unit in Merjan teaching hospital which compared with 30 healthy as control group. All patients were dialyzed three times a week and each session was at least four hours. They were dialyzed with polysulfone dialyzing membrane. The duration of dialysis ranged from 2-8 years. Subjects suffering from diabetes, acute renal failure, cardiovascular disease, hepatic disease, and any chronic or acute inflammatory illness were excluded from the study. Venous blood (5 ml) was obtained from each patient before and after dialysis. Serum then was separated by centrifugation for (10) minutes, and then divided in aliquots for measurement of serum K⁺, Na⁺, Cl⁻ as well as serum level of creatinine and urea. The control groups consisted of 30 non-hospitalized adults with no history of systemic disease (matched for age and sex).

Result

In chronic kidney disease patients, serum Urea and Creatinine level was significantly high in pre- HD patients compared to healthy controls as shown in table No(1). The mean levels of serum sodium in pre -HD patients was lower than healthy controls as shown in table (1), also the mean Serum chloride level in pre-HD patients was higher compared to controls as shown in table (1) However, the mean level of serum K⁺ value was significantly high in pre- HD patients compared to healthy controls as shown in table No(1).

Table 1: Mean±SD of serum electrolytes (Na⁺, K⁺, Cl⁻), level of urea and serum creatinine in controls and pre-hemodialysis patients

Parameters	Healthy controls	Pre hemodialysis patients	P. value
Urea (mmol/l)	4.191 ± 0.80	27.47 ± 8.6	0.0001
Creatinine(μmol/l)	68.04 ± 3.99	525.58 ± 106.56	0.0001
Na ⁺ (mmol/l)	140.37 ± 1.9	136.87 ± 4.14	0.001
K ⁺ (mmol/l)	3.79 ± 0.65	4.48 ± 0.83	0.0001
Cl ⁻ (mmol/l)	105.04 ± 3.4	106.12 ± 4.02	0.359

P- Value less than 0.05 (significant)

The mean value of blood urea and serum creatinine in the pre-dialysis pts., was higher than post dialysis patients as shown in table No.2, and in post-HD patient's serum Na⁺ levels was slightly higher than pre -HD patients as shown in the table 2. However, the mean level

of serum K⁺ is significantly lower in post -HD patients compared to pre - HDs patients as shown in table No.2, also the mean serum chloride levels in pre -HD patients not significantly affected after hemodialysis.

Table 2: Mean±SD of serum electrolytes (Na⁺, K⁺, Cl⁻), level of urea and serum creatinine levels in pre-HD and post - HD patients

Parameters	Pre hemodialysis patients	Post hemodialysis patients	P. value
Urea (mmol/l)	27.47 ± 8.6	20.72 ± 21.40	0.0001
Creatinine(μmol/l)	525.58 ± 160.56	267.91 ± 84.02	0.0001
Na ⁺ (mmol/l)	136.87 ± 4.14	138.00 ± 4.41	0.03
K ⁺ (mmol/l)	4.48 ± 0.83	3.69 ± 0.65	0.0001
Cl ⁻ (mmol/l)	107.12 ± 4.02	106.12 ± 4.11	0.06

P- Value less than 0.05 (significant)

Discussion

The current study show that serum potassium level in post - HD patients was significantly low compared to mean serum level of pre-HD patients. Hyperkalemia reduces the resting membrane potential, slow the conduction velocity and increases the rate of repolarization. Hypokalemia on the other hand increases the resting membrane potential, and refractory period, which are potentially arrhythmogenic. The obtained result was consistent with that reported by Sreenivasulu et al. stated that mean serum potassium levels in post-HD were low compared to pre-HD Patients^[11]. Also, The result consistent with other study^[12,13,14,15], observed that mean serum potassium levels in post-HD (3.69±0.65) were low compared to pre-HD Patients (4.48±0.83).

The study results show that chronic kidney disease patients has high level of serum urea is relative to the progression of the disease and is highly influenced by a catabolic state or excessive protein ingestion, leading to a higher production of other waste substances of protein catabolism, and creatinine level increase in chronic kidney disease patients that recognized by low no. of working nephrons, this lead to decrease in GFR, cause significant lowering in the renal flow of water and solutes, this result matches with the result of (Noor ul Amin.)^[16].

In the present study mean serum sodium levels in post-dialysis patient was slightly higher when compared to mean serum sodium levels of pre dialysis patients. Seethalakshmi reported that the mean Na⁺ concentration in post -hemodialysis (138.00 ±4.41) patients was high compare to prehemodialysis patients (136.87±4.14)^[15]. A study by Nauman observed that mean serum Na⁺ post-hemodialysis patients (138.00±4.41) were higher when compared to pre-hemodialysis patients (136.87±4.14)^[13]. In chronic Hemodialysis patients, sodium (Na⁺) balance largely depends on inter dialytic dietary salt intake and intra dialytic Na⁺ removal^[17]. Dialysis patients appear to have a unique set point for serum sodium^[18]. In over-all level of serum K⁺ after HD increase 2-4 meq/L suggesting that HD cause hyponatremia and transferrable Na⁺ pool is partly depleted of excess Na⁺^[19].

In the present study mean serum chloride level in post -HD pts was low compared to pre HD pts. A study by Kirschbaum B^[14] shows that mean serum chloride level in post HD patients (Mean-100) was low compare to pre HD patients (Mean-103).

Conclusion

There is decrease in s. urea besides creatinine level between period before and after hemodialysis, also s. K⁺ level decreased after hemodialysis. Although serum sodium and chloride levels not significantly affected after hemodialysis.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq.

Conflict of Interest: Non

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