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Original Research Article

A Prospective Study to Assess Electrolyte Changes after Hemodialysis among Chronic Kidney Disease Patients.

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Abstract

Introduction: Acid-base and electrolyte homeostasis is vital for proper functioning of numerous metabolic processes and organ functions in the human body. Kidney diseases and dysfunction (chronic kidney disease, CKD) compromise the regulatory functions, resulting in alterations in electrolyte and acid-base balances that can be life-threatening.

Aim: to assess electrolyte changes after hemodialysis among chronic kidney disease patients.

Method: The index study was a cross sectional study conducted at the Department of Medicine, Rama Medical College and Research Institute, Hapur for a period of 6 months from 1st April 2022 to 30th September, 2022. The study included a total of 250-300 consenting adult patients who were either diagnosed with Chronic Kidney Diseases undergoing hemodialysis or patients referred from other institutions for hemodialysis.

Results: Post dialysis sodium was statistically significantly higher than post dialysis sodium. Pre dialysis chloride was statistically significantly higher than post dialysis chloride.

Conclusion: We found that post hemodialysis, serum potassium and chloride reduced and serum sodium increased.

Keywords: Hemodialysis, Sodium, chloride, potassium, chronic kidney disease

Introduction

Acid-base and electrolyte homeostasis is vital for proper functioning of numerous metabolic processes and organ functions in the human body. Kidneys play a critical role in the maintenance and regulation of this homeostasis. Kidney diseases and dysfunction (chronic kidney disease, CKD) compromise the regulatory functions, resulting in alterations in electrolyte and acid-base balances that can be life-threatening. [1-4].

In most patients with stable CKD, the total-body content of sodium and water is modestly increased, although this may not be apparent on clinical examination. With normal renal function, the tubular reabsorption of filtered sodium and water is adjusted so that urinary excretion matches intake. Many forms of kidney disease (e.g., glomerulonephritis) disrupt this balance such that dietary intake of sodium exceeds its urinary excretion, leading to sodium

retention and attendant extracellular fluid volume (ECFV) expansion. This expansion may contribute to hypertension, which itself can accelerate the nephron injury.[3-5]

In CKD, the decline in GFR is not necessarily accompanied by a parallel decline in urinary potassium excretion, which is predominantly mediated by aldosterone-dependent secretion in the distal nephron. Another defense against potassium retention in these patients is augmented potassium excretion in the GI tract. Notwithstanding these two homeostatic responses, hyperkalemia may be precipitated in certain settings. These include increased dietary potassium intake, protein catabolism, hemolysis, hemorrhage, transfusion of stored red blood cells, and metabolic acidosis.

In addition, a host of medications can inhibit renal potassium excretion and lead to hyperkalemia. [2,4,6]

Metabolic acidosis is a common disturbance in advanced CKD. The majority of patients can still acidify the urine, but they produce less ammonia and, therefore, cannot excrete the normal quantity of protons in combination with this urinary buffer. Hyperkalemia, if present, further depresses ammonia production. The combination of hyperkalemia and hyperchloremic metabolic acidosis is often present, even at earlier stages of CKD (stages 1–3), in patients with diabetic nephropathy or in those with predominant tubulointerstitial disease or obstructive uropathy; this is a non-anion-gap metabolic acidosis. [5,6] The aim of the index study has been to review the changes in the electrolytes before and after the dialysis procedure among the chronic kidney disease patients.

Methodology:

The index study was a cross sectional study conducted at the Department of Medicine, Rama Medical College and Research Institute, Hapur for a period of 6 months from 1st April 2022 to 30th September, 2022. The study included a total of 250-300 consenting adult patients who were either diagnosed with Chronic Kidney Diseases undergoing hemodialysis or patients referred from other institutions for hemodialysis. Inclusion criteria included patients with age >18 years, diagnosed as a case of CKD stage 4 or 5, who attended dialysis units at the Department of Medicine. Patients with acute kidney injury, active malignancy and pregnancy were excluded from this study.

After obtaining ethical clearance from the Institutional Ethical Committee and written consent from all the study participants, detailed data regarding socio demographic variables was obtained from all the study participants and entered in study proforma. Blood sample were collected from all the patients under aseptic precautions and was subjected to CBC along with hemoglobin estimation and Serum Electrolytes levels. The samples were collected on the day of performing dialysis before and after undergoing the respective procedure. Electrocardiogram was performed under aseptic precautions.

Patients with Sodium level <135 were categorised as low sodium levels (hyponatremia) and levels >145 as high sodium levels (hypernatremia), Potassium levels <3.5 as low (hypokalemia) and levels >5.5 as high (hyperkalemia), Chloride levels <95 as low (hypochloremia) and more than >105 as high (hyperchloremia). Anemia was diagnosed if values were less than 11 gm%. Peripheral smear findings were taken into consideration to determine the type of anemia.

Results:

The study involved a total of 214 subjects with mean age 48.7 years [SD 13.9]. Among the study participants, 34.1% were females and the rest were males. The mean pre and post dialysis weight of the participants was 59.4 Kg [SD 12] and 56.9 Kg [SD11.8], respectively. Pre dialysis weight was statistically significantly higher than the post dialysis weight.

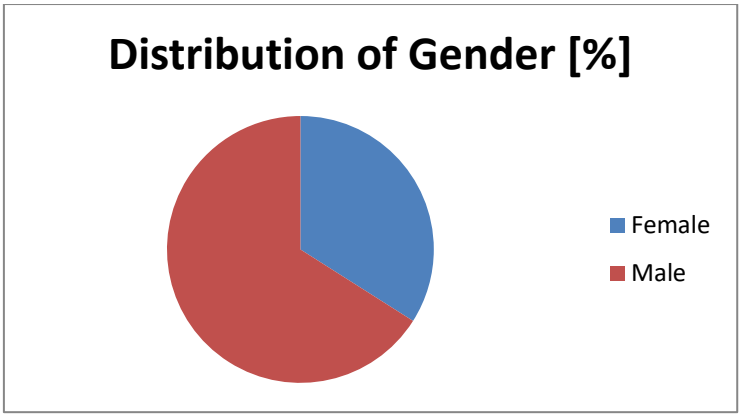

Figure 1: Pie chart showing gender distribution of the study participants

Table 1: Electrolytes pre and post Dialysis

	N	Mean	Std. Deviation	Minimum	Maximum
Predialysis Weight	214	59.4555	12.02974	27.80	86.50
pre_dialysis K*	214	5.29	1.030	3	8
pre_dialysis Cl*	214	107.18	3.007	98	118
Pre_dialysis_Na*	214	139.12	3.475	114	149
Postdialysis Weight	214	56.9462	11.85122	25.50	85.40
post_dialysis K*	214	3.74	.842	2	7
post_dialysis_Cl*	214	105.71	2.497	98	114
post_dialysis Na*	214	140.64	3.754	106	149

*[K= potassium, Cl= Chloride, Na= Sodium]

From the above table [table 1], we can make out Pre dialysis potassium was statistically significantly higher than post dialysis potassium. Post dialysis sodium was statistically significantly higher than post dialysis sodium. Pre dialysis chloride was statistically significantly higher than post dialysis chloride [$p< 0.05$]. To sum up, pre-dialysis potassium and chloride were higher and post dialysis sodium was higher.

Discussion:

The current study was a cross sectional study conducted at the Department of Medicine, Rama Medical College and Research Institute, Hapur for a period of 6 months. The study included a total of 250-300 consenting adult patients and the aim of the study was to assess the changes in serum electrolytes after hemodialysis.

We found that post hemodialysis, serum potassium and chloride reduced and serum sodium increased. All these findings were statistically significant. Here we have tried to bring together and discuss the various researches on the said topic.

Maintenance HD provides a lifesaving therapy that has become increasingly available to patients with End stage kidney disease across the world. Despite familiarity with this process from over 50 years of clinical use, descriptions of the magnitude of change in serum electrolytes with contemporary practice remain necessary to augment current clinical understanding of the biochemical changes during hemodialysis on the one hand, while providing important data for dialysate prescription research on the other.

Dialysate potassium is typically prescribed with the goal of lowering serum (and total body) potassium concentrations that have risen in the interdialytic period. Recent research has called particular attention to the observation that post-hemodialysis hypokalemia, especially in the setting of pre-hemodialysis hypokalemia, is associated with higher all-cause mortality.

[7] Although serum potassium continues to "rebound" when measured 6 hours post-HD [8], these data support the concept of a higher-risk period peri- and immediately post-HD, which temporally aligns with the periods of highest risk for clinically significant arrhythmia in the primary analyses of the MiD study [9]. Our findings demonstrate that post-HD hypokalemia is common.

In the study by Correa S etal[6], post hemodialysis sodium increased and chloride reduced. Liborio etal [10] tried to correct the unmeasured anions through hemodialysis , but reported unchanged chloride post dialysis. The patients in their study presented acidosis related to hyperchloremia, hyperphosphatemia, and high unmeasured anions. Hypoalbuminemia had an alkalinizing effect. Hemodialysis corrected acidosis mainly by reducing phosphate and unmeasured anions. In the group as a whole, chloride levels did not change after dialysis. However, when analyzed according to predialysis plasma chloride, the high-chloride group presented a reduction in plasma chloride, resulting in better base excess improvement (Delta standard base excess) than in the low-chloride group.

Postdialysis serum sodium concentrations are affected by the dialysate sodium concentration; the dialysate sodium concentration used in the study by was 138 mEq/L. A dialysate sodium prescription> 138 mEq/L may result in a positive dialysate-to-serum sodium gradient in most patients. [11] However, previous simulation studies have shown that serum sodium concentration decreases during HD using a normal dialysate sodium concentration. Net sodium transfer from serum to dialysate can occur, and a negative sodium balance would result in blood pressure changes. [12,13]

Conclusion: We found that post hemodialysis, serum potassium and chloride reduced and serum sodium increased. All these findings were statistically significant. Here we have tried to bring together and discuss the various researches on the said topic.

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