Impact of Dialysis on serum electrolytes in End stage renal disease

Dr. Monisha.M*1, Dr. Radhika.G2, Dr. Muraliswaran.P3,

1(III year Post Graduate, Department of Biochemistry, SVMCH&RC, Puducherry, India)
2(Professor and Head, Department of Biochemistry, SVMCH&RC, Puducherry, India)
3(Professor, Department of Biochemistry, SVMCH&RC, Puducherry, India)
4(Assistant Professor, Department of Biochemistry, SVMCH&RC, Puducherry, India)

Abstract: Chronic renal failure is a leading cause of death in developed countries. Over years there has been increase in the number of patients with chronic kidney disease (CKD). Hemodialysis (HD) is one of the main treatments for end-stage renal disease (ESRD). Here we have studied the impact of hemodialysis on electrolyte balance, urea and creatinine levels in patients on maintenance hemodialysis. The current study aims to assess the impact of dialysis on serum electrolytes in ESRD. A cross-sectional study which was done in maintenance hemodialysis patients. 47 patients were selected according to their inclusion and exclusion criteria and their blood samples were analysed for various parameters. Statistical Analysis was done by SPSS software. There is an increase in mean sodium from 134.17±3.19 to 138.38 ±3.70 (p<0.0001) and chloride from 102.29±4.14 to 107.36±3.93 (p<0.0001). There is a reduction in potassium levels from 5.83±1.09 to 4.91±1.07 (p<0.0001) after dialysis. Serum sodium and chloride show significant increase and potassium shows significant reduction post dialytically.

Keywords: End stage renal disease, hemodialysis, electrolytes.

Date of Submission: 22-08-2018  Date Of Acceptance: 04-09-2018

I. INTRODUCTION

CKD was first defined by GFR less than 60 ml/min/1.73 m² for the duration of 3 months or longer with disease severity was staged only by GFR1. The prevalence of CKD is 17.2% with stage I, 7% in stage II, 4.3% in stage III, 4.3% in stage IV, & 8% in stage V respectively2. The major complications of CKD are cardiovascular disease, anemia, infectious complications, neuropathy and abnormalities related to mineral bone metabolism3. The disturbances in acid-base and electrolyte balance in CKD can have a greater impact on a patient’s well-being and also leads to increased morbidity and mortality. Dysnatremia is one of the common electrolyte disorder in clinical practice which is observed in many of the medical conditions, including chronic kidney disease5,6. HD removes sodium by the method of ultrafiltration and diffusion. Literature document hyperkalemia occurs very commonly in CKD patients due to progression of reduced urinary output, reduced potassium clearance, shift of potassium from the intracellular to the extracellular space in the in renal failure, and the usage of drugs such as ACE and ARB inhibitors7-12. Very high serum potassium levels predispose to arrhythmia and sudden death in CKD13. The aim of this study was to evaluate the pre and post dialysis electrolyte changes in ESRD patients.

II. MATERIAL AND METHODS

It is a Cross-sectional Study with samples collected from 47 patients with ESRD undergoing dialysis which is conducted after obtaining Institutional ethics clearance and informed consent. Their mean duration of dialysis was 3.5-4 hours. All the patients were treated with bicarbonate dialysate with electrolyte concentration as follows: Na⁺-135mmol/L; K⁺-2 mmol/L; bicarbonate – 32mmol/L. Blood flow rate was 300 ml/minute with a dialysate flow of 500 ml/min. Dialysis was done using polysulfone based dialysis membrane.

Study Design: Cross-sectional study

Study Location: This was a tertiary care teaching hospital based study done in Department of Biochemistry, at Sri Venkateshwaraa medical college hospital and research centre, Puducherry.

Sample size: 47 patients.

DOI: 10.9790/264X-0404024953 www.iosrjournals.org
Subjects & selection method: The study population was drawn from dialysis unit who presented to Sri Venkateshwaraa medical college hospital and research centre with End stage renal disease undergoing maintainance hemodialysis.

Inclusion criteria:
Subjects undergoing maintenance hemodialysis of age group 35 – 70 years (both sexes) were included under the study.

Exclusion criteria:
The subjects diagnosed with liver, cardiac diseases and those who are taking drugs like ACE and ARB inhibitors were excluded from the study.

Procedure methodology
5ml of venous blood sample is collected from each patient before and after haemodialysis. Urea, creatinine, sodium, potassium and chloride were analysed. The Blood urea was estimated by Glutamate Dehydrogenase (GLDH) method and serum creatinine was estimated by Jaffe's method in autoanalyser. Serum sodium, potassium, and chloride were estimated by Electrolyte test kit.

Statistical analysis
The data was entered in MS Excel and expressed in Mean and standard deviation. To find the significant difference between pre and post dialysis, paired t test was performed. ANOVA was done to find the significant among the three groups. Statistical Analysis was done by SPSS software. p value<0.05 is considered as statistical significant.

III. RESULT
The 47 patients included based on the inclusion and exclusion criteria, in those 40 (85%) males and 7 (15%) females with mean age group 54.48±9. When the subjects were grouped, we found 10 (21%) of patients have diabetes with CKD, 25 (53%) have hypertension with CKD and 12 (26%) have both the co-morbidities with CKD. There is increase in percentage of patients with hypertensive nephropathy in accordance with the study Hörl MP et al who stated the majority of patients undergoing hemodialysis are hypertensive.

Table 1: Characteristic of pre and post hd electrolytes, urea and creatinine.

<table>
<thead>
<tr>
<th>BIOCHEMICAL PARAMETERS</th>
<th>PRE HD</th>
<th>POST HD</th>
<th>p VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SODIUM</td>
<td>134.17± 3.19</td>
<td>138.38 ±3.70</td>
<td>0.0001</td>
</tr>
<tr>
<td>POTTASIM</td>
<td>5.83± 1.09</td>
<td>4.91± 1.07</td>
<td>0.0001</td>
</tr>
<tr>
<td>CHLORIDE</td>
<td>102.29±4.14</td>
<td>107.36±3.93</td>
<td>0.0001</td>
</tr>
<tr>
<td>UREA</td>
<td>117.61±24.54</td>
<td>97.76±24.07</td>
<td>0.0001</td>
</tr>
<tr>
<td>CREATININE</td>
<td>9.21±2.64</td>
<td>7.48±2.43</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Table 1 shows the comparison between pre and post HD values of electrolytes, urea and creatinine. The paired t-test analysis was done in pre and post-blood urea, creatinine and electrolytes which was significant with a p-value of < 0.0001.
Table 2: ANOVA RESULTS-PRE AND POST HD ELECTROLYTES, UREA AND CREATININE

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre- Na+</td>
<td>53.530</td>
<td>2</td>
<td>26.765</td>
<td>2.039</td>
<td>.142</td>
</tr>
<tr>
<td>Between Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>577.577</td>
<td>44</td>
<td>13.127</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>631.106</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre- K+</td>
<td>11.586</td>
<td>2</td>
<td>5.793</td>
<td>2.638</td>
<td>.083</td>
</tr>
<tr>
<td>Between Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>96.627</td>
<td>44</td>
<td>2.196</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>108.213</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre- CL-</td>
<td>29.194</td>
<td>2</td>
<td>14.597</td>
<td>.939</td>
<td>.399</td>
</tr>
<tr>
<td>Between Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>683.657</td>
<td>44</td>
<td>15.538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>712.851</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre UREA</td>
<td>1776.480</td>
<td>2</td>
<td>888.240</td>
<td>1.507</td>
<td>.233</td>
</tr>
<tr>
<td>Between Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>25936.627</td>
<td>44</td>
<td>589.469</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27713.106</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre- CREAT</td>
<td>10.556</td>
<td>2</td>
<td>5.278</td>
<td>.701</td>
<td>.502</td>
</tr>
<tr>
<td>Between Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>331.317</td>
<td>44</td>
<td>7.530</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>341.872</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On subgroup analysis, there is no significant difference among the groups, still, potassium showed maximum F value which indicates that it shows some difference among the subgroups as shown in Table 2.

IV. DISCUSSION

Hemodialysis is the first line of treatment in almost all patients with ESRD which would postpone renal transplantation. In this study we assessed the pre and post dialytic changes in electrolytes in ESRD patients. Adequate dialysis has prolonged the survival of patients with improved quality of life. Cardiovascular disease was found to be the most frequent cause of mortality in majority of patients on maintenance hemodialysis.

Hemodialysis proved an effective impact on serum urea and creatinine level which is reduced post dialytically. Analytical results showed that after dialysis, all the patients had reduction in urea from 117.61±24.54 to 97.76±24.07 and serum creatinine from 9.21±2.64 to 7.48±2.43 with a statistically significant paired t-test which is consistent with the study of seethalakshmi et al study where the pre and post dialysis urea level was 132.34±32.81 and 51.20±16.19 and creatinine levels were 8.68±2.77 and 4.12±1.48 respectively.

Urea and creatinine, being small molecules, is removed mainly due to the counter-current flow of the blood and dialysate which maximize the concentration gradient of solutes between the blood and dialysate, which helps to remove more urea and creatinine from the blood after dialysis.

Present study results showed hyponatremia in pre dialysis state and gets corrected after dialysis, which is in accordance with NaumanTarif et al study where mean sodium level is higher in post dialytic serum level. The malfunctioning of aldosterone and renin-angiotensin system contributes to the decreased pre HD sodium. The raise in post HD sodium is due to the reduced intra dialytic removal.

The ESRD patients usually presents with hyperkalemia which predispose to cardiovascular effects like decrease in the action potential, widening of QRS complex and prolongation of PR interval. ECG changes occurs during haemodialysis due to quick shift of serum K+ which leads to hypokalemia which requires careful monitoring and intervention. But in this study hyperkalemia persists pre dialytically which turns normal after dialysis. The removal of potassium by haemodialysis is largely determined by the potassium concentration gradient between the plasma and the dialysate.

V. CONCLUSION

Current study there was significant effects of HD on serum electrolytes, urea and creatinine. Improvement in electrolytes like serum sodium and potassium have prognostic significance in chronic renal failure. Therefore, electrolyte values and dialysate fluid should be considered before dialysis for all patients. It is recommended that the dialysate to be altered in accordance with pre dialytic electrolyte changes for each and every patient to prevent or treat serious effects due to electrolyte imbalance.
Effect of Dialysis on serum electrolytes in End stage renal disease

REFERENCES


DOI: 10.9790/264X-0404024953 www-iosrjournals.org 52 | Page

ACKNOWLEDGEMENT

We would like to thank Dr. N. Bhuvaneshwari, Department of Nephrology, SVMCH&RC for her assistance in research work.