EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 5
Issue: 4
996-1000
Year: 2018

LEVELS OF MINERALS AND ALBUMIN IN PRE AND POST HEMODIALYSIS PATIENTS

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Article Received on 19/02/2018 **Article Revised on 11/03/2018** **Article Accepted on 01/04/2018**

ABSTRACT
Background: Chronic kidney disease (CKD), featured by significant impairment of renal function, is a one of the major public health problems globally. Renal replacement therapies like dialysis and transplantation has increased the survival rate in CKD subjects worldwide. In past few years, the most preferable treatment for CKD patient is hemodialysis (HD). **Aim and Objectives:** The aim of this study is to estimate the clinical utility of minerals and albumin estimations in CKD patients underwent hemodialysis procedure. **Martial and Methods:** In this study, 50 chronic renal failure (CRF) patients receiving hemodialysis and 50 healthy controls of both the gender matching in age and sex were included. The patients were chosen on their estimated glomerular filtration rate (eGFR). The analysis of biochemical parameters like blood urea, serum creatinine, serum calcium, phosphorous, magnesium and albumin were estimated by autoanalyzer using kit reagents. Values were expressed as mg/dL. **Results:** In the present study posthemodialytic samples showed significantly high values of blood urea, serum creatinine, phosphorous and serum magnisium as compared to healthy controls but significantly lower than the pre haemodialysis samples. Mean values of serum calcium significantly reduced in posthemodialytic smaples as compared to controls but significantly higher as compared to prehaemodialysis. The mean values of serum albumin remains low as compared to prehaemodialysis and controls. **Conclusion:** In this study, serum minerals and albumin acting as a strong and independent predictor of overall mortality and cardiovascular outcome in CKD patients receiving haemodialysis treatment.

KEYWORDS: Chronic kidney disease (CKD), Hemodialysis (HD), estimated glomerular filtration rate(eGFR), Cardiovascular disease.

INTRODUCTION
Chronic kidney disease (CKD) is one of the major public health problem globally and it is associated with and an increased risk of mortality.[1] It is characterized by slow, progressive and irreversible impairment of renal functions and decreased in glomerular filtration rate (GFR).[2,3] Renal replacement therapies like dialysis and transplantation has increased the survival rate in patients with CKD worldwide.[4]

In recent years, the most preferable treatment of CKD is hemodialysis (HD). During hemodialysis essential kidney functions, such as the elimination of water and metabolic wastes as well as the correction of the electrolyte and acid base balance are replaced by the artificial purification system.[5,6] Despite continuous progress in the delivery of renal replacement therapy, mortality in patients on maintenance dialsysis remains higher than in the general population. The socio-economic factors and its associated complications may create serious nutritional complications in CKD patients during the course of predialysis and dialysis, which eventually affect the prognosis and quality of life of patients with CKD.[7]

CKD patients are more prone to develop various complications including malnutrition and early detection of nutritional status is important for monitoring the

disease pattern in CKD patients. Disturbed mineral metabolism is a prevalent condition in chronic kidney disease (CKD) and it is mostly associated with cardiovascular complications.[8-10] Albumin is the most specific significant biochemical marker of protein reserves to measure severely and associated clinical events in the CKD and for being powerful predictor of morbidity and mortality in CKD.[11]

In recent years, the important prevalence and relevance of alterations of mineral metabolism and inflammation in CKD patients, the interrelationships among these factors have been scarcely analyzed, especially in predialysis and post heamodialysis patients. Therefore a close monitoring and biochemical investigations follow up is essential, so as to achieve the greatest outcome. Blood urea, serum creatinine, serum calcium, serum phosphorous, magnisium, total protein and albumin act as conventional and nutritional markers in pre and post hemodialysis patients and these markers appear to have certain beneficial remarks in that they can provide an earlier response to nutritional changes in CKD patients and they can be more precisely measured. The aim of this study was to estimate the potential clinical utility of minerals and albumin estimations with CKD patients receiving hemodialysis.

MATERIAL AND METHODS

In the present study, 50 CRF patients and 50 healthy controls of both the gender matching in age and sex were included. The patients were selected on the basis of their estimated glomerular filtration rate (eGFR). CKD was staged according to National Kidney Foundation guidelines and the stages of CRD varied between 1 to 5 by using the patients estimated glomerular filtration rate.[12,13] All the selected patients were in the 4th and 5th stages of CRF, undergoing hemodialysis treatment.

The exclusion criteria were includes smoking habit, malignancy, liver disease, infectious, inflammatory disease and cardiovascular disease. The subject who are willing to precipitate with informed consent were included in the present study. All controls were free from infection and on no medication during the last two weeks. The research study protocol was approved by institutional ethical committee and informed consent were obtained in written form from each subject before they were included in the study. Hemodialysis was carried out four hours per session by using high flux polysulphone hemodialysis membrane.

These samples were analyzed to observe the effect of hemodialysis procedure on the biochemical parameter. On the day of dialysis, all patients arrived after overnight fasting. The samples of blood were collected from each patient before and after hemodialysis under aseptic precautions using vacutainers. The blood sample was allowed to clot at room temperature and serum was separated for analysis of biochemical parameters. The analysis of biochemical parameters was done by using standard grade reagents and chemicals. Blood urea, serum creatinine, serum calcium, phosphorous, magnesium, and albumin were assayed on autoanalyzer by using diagnostic reagent kit.[14]

RESULTS

The SPSS software, version22 was used to analyze the statistical analysis. Results are expressed as means and Standard Deviation (SD). Data was presented as mean ± S.D and student parried "t" test was used to compare the groups. The level of statistical significance was set at P<0.001.

Table 1: Levels of biochemical parameters in pre and post haemodialysis samples of CKD patients and controls subjects.

Sr. No.	Biochemical Parameters	Controls N=50	Pre HD N=50	Post HD N=50
1.	Blood Urea (mg/dL)	24.13 ± 3.96	136.75 ± 28.40 ***	70.13 ± 14.42 ***
2.	Serum Creatinine (mg/dL)	1.01 ± 0.21	9.42 ± 2.13 ***	5.1 ± 1.29 ***
3.	Serum Calcium (mg/dL)	9.28 ± 0.71	7.11 ± 0.80 ***	7.54 ± 0.81 ***
4.	Serum Phosphorous (mg/dL)	3.79 ± 0.61	5.66 ± 0.34 ***	4.57 ± 0.34 ***
5.	Serum Magnesium (mg/dL)	2.23 ± 2.27	3.93 ± 0.51 ***	3.12 ± 0.40 ***
6.	Serum Albumin (gm/dL)	4.74 ± 0.39	3.19 ± 0.25 ***	2.81 ± 0.20 ***
***P<0.001 – Highly Significant				

In this research study posthemodialsis (Post HD) values showed significant elevation in blood urea, serum creatinine, Phosphorous and serum Magnesium (P<0.001) as compared to controls but significantly lower value than the pre haemodialysis (Pre HD) samples. Mean values of serum calcium significantly reduced (P<0.001) in posthemodialysis group as compared to controls but significantly (P<0.001) higher

value than prehaemodialysis group. Mean values of serum albumin was significantly lower (P<0.001) in prehaemodialysis (Pre HD) and posthaemodialysis (Post HD) as compared controls.

DISCUSSION

Chronic kidney disease (CKD) is recognized as a major health problem. This disorder is characterized by rapid decline of glomular filtration rate (GFR) and in the accumulation of various toxic substances, causing uremic syndrome.[15] As per the stages of Chronic Kidney Disease (CKD), nutritional requirements are impaired and metabolism of protein, water, salt, potassium and phosphorous are affected as well as metabolic changes occurs.[16] These changes might be creating to insufficient energy formation despite sufficient intake of protein and carbohydrate substrates. In more extreme manifestations, these alterations in nutrient utilization cause uremic malnutrition. Uremic malnutrition in patients with CKD progressively deteriorates as renal function worsens and associated with increased morbidity rates in CKD populations.[17]

Hemodialysis is considered as a good therapeutic approach in the context of the renal replacement therapies.[18] Many factors leads to serious nutritional complications for CKD patients during the course of hemodialysis, which eventually affect the prognosis and quality of life of patients with CKD.[19] Numerous studies have documented that the importance of abnormal mineral metabolism and inflammation as highlighting factors for the increased cardiovascular risk in CKD patients. Therefore, it is important to identify, treat and prevent conditions associated with poor clinical outcomes.[20]

In this study, we explored the associations of calcium, phosphorous, magnesium, albumin and to find out the efficacy of hemodialysis on biochemical parameters in CKD patients. In CKD the significant increase of blood urea is proportional to the progression of the disease, but it is highly affected by a catabolic state or an excessive protein intake, leading to a higher production of other waste substances of protein catabolism[21] while the remarkable elevation of creatinine level in the serum of CKD patients is attributed to the decrease in the number of functioning nephrons, which would reduce the GFR, which causes major decrease in renal excretion of waste products.[22] The decrease in the level of urea and creatinine in post dialysis patients compared with predialysis patients might be due to that haemodialysis which removes toxins and metabolic waste from the blood by a closed loop process where the blood of the CKD patients and is continuously being withdrawn, dialyzed, and returned to the patients.[23] The concomitant fall in serum urea and creatinine, which is an accepted clinical index for the adequacy of dialysis.

The potential role of serum calcium in the prediction of CKD progression is not well established in the previous studies. The concentration of calcium remains low after hemodialysis in CRF patients when compared with the controls but significantly higher than the pre hemodialysis group, while the concentration of phosphorus becomes low in post dialysis compared with predialysis but it is significantly elevated as compared to controls. Calcium homeostasis is significantly altered in CKD might be due to intestinal calcium absorption appears to be decreased in renal failure patients due to the impaired synthesis of calcitriol and acidosis causable for tubular damage.[24] Few study also reported that decreased serum calcium levels in predialysis might be due to reduced GFR or impaired levels of Parathyroid hormone (PTH).[25,26] In our study we observed that serum calcium is decreased in chronic kidney disease patients and the mean values are not much more altered in post dialysis condition. Impaired phosphate excretion with resulting hyperphospatemia is one of the earliest consequences of CKD patients. Application of high flux membranes during hemodialysis increasing the surface area of the dialyzer membrane can remove phosphate more the efficiently, although to protect lower intracellular phosphate concentration in not encountered during dialysis.[27,28] Therefore, in this study, we assumed that serum calcium and phosphorous is acting as an independent, prognostic marker of rapid renal function deterioration in CKD patients.

Magnesium (Mg^{++}) is the most abundant cation in the body and is involved cell functions. The kidney plays vital role in magnesium homeostasis. In normal health, the kidney, gastrointestinal tract and bones are responsible for maintaining magnesium balance and keeping serum magnesium concentration in normal level. Significant increase in the serum magnesium before dialysis compared with post dialysis and control group. In CKD, as renal function further deteriorates, the quantitative excretion of magnesium tends to decrease and cannot be compensated any longer by an increased fractional excretion of magnesium.[29,30]

Previous studies have demonstrated that serum albumin is a prognostic marker of nutritional status, and that it also causable to nutritional involvement. In CKD patients have substantially altered total body water metabolism and experience frequent changes in plasma volume, both of which are known to affect on albumin turnover and serum albumin concentration. Chronic inflammatory condition in CKD also one of the cause to influence albumin turnover.[31,32] Despite inherent limitations, serum albumin is routinely assessed to identify potentially low protein stores and nutritional status in CKD and ESRD patients. In our research work we found that, serum albumin significantly lower in posthaemodialysis as compared prehemodialysis and controls patients. Few study also documented[33] that losses of albumin in the post dialysis patients might be due to increased porosity of the membrane because of the action of chemicals used for processing the dialyzer like blench, tend to enlarge the pore of membrane.

Uremic malnutrition is very prevalent in CKD patients receiving hemodialysis. Several research studies have established a correlation between malnutrition and poor clinical outcome. In haemodialysis patients, serum minerals and albumin acting as a strong and independent predictor of overall mortality and cardiovascular outcome. Malnutrition and sever comorbidity carried over from the dialysis period of CKD patients may lead to impaired immune function and inadequate host resistance, resulting in increased susceptibility to infections. Impaired host resistance, may predispose to inflammatory diseases with endothelial dysfunction, predisposing to atherosclerotic process and associated with increased mortality risk.[34] These findings gives the support to the hypothesis that impaired levels of minerals and serum albumin is an important risk factor for cardiovascular event in patients with chronic renal failure receiving dialysis. Routine estimation of these markers in CRF patients receiving hemodialysis would help to overall clinical status of the patients.

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