

Effect of Dialysis on Certain Biochemical Parameters in Chronic Renal Failure Patients

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ABSTRACT

Introduction: One of the slowly progressive diseases of the kidney functions is chronic renal failure (CRF) and is characterized by low glomerular filtration rates (GFR). Special replacement therapy of renal system is required for its treatment. One such line of treatment is dialysis which involves removal of excessive toxic fluids and metabolic end products from the body. Hence; we evaluated the pre-dialysis and post-dialysis mean values of serum renal biochemical markers in CRF patients undergoing dialysis to elucidate the effect of dialysis on CRF patients

Material and methods: The present study was conducted in renal failure patients who were on dialysis in the age group of 18 to 65 years consisting of males and females. 18 normal individuals whose renal parameters were within normal limits and with no history of renal impairment in the past were also selected between the comparable age group. Within one week to 10 days of sample collection, serum copper and zinc were estimated by atomic absorption spectrophotometer (AAS). Other biochemical tests were done on the same day or next day. Measurement of blood urea was done by Diacetyl monoxime method. Serum creatinine was estimated by colorimeter using Jaffe's alkaline picrate method. Serum sodium and potassium were estimated by flame photometer. Serum calcium was estimated by titration method using ethylene diamine tetracetic acid. Serum phosphate was estimated by colorimeter using Fiske and Subbarow method. All the data were collected, summarized and analyzed by SPSS software.

Results: The blood urea values in pre-dialysis group were significantly higher. The blood urea level in post-dialysis group was significantly lower. Serum copper value in both the pre-dialysis and post-dialysis group was significantly lower in comparison with the control group. However, the mean values in post-dialysis group were lower in comparison with the pre-dialysis group. Serum calcium levels in post-dialysis group were higher than in pre-dialysis group. Serum calcium levels in pre-dialysis group were lower. Serum phosphorus levels in pre-dialysis group were statistical significantly higher in comparison with the post-dialysis group.

Conclusion: The post-dialysis serum concentration of sodium and calcium depend upon the dialysate composition of these elements and also serum which is available for ultra-filtration

Key words: Biochemical, Dialysis, Renal

Physiologic function of kidney involves removal of waste products and fluids from the blood stream and disposing them through the urine route.⁵ In patients who have suddenly lost their renal function or who have reached end stage renal stage, one line of treatment involves dialysis which involves removal of excessive toxic fluids and metabolism's end products from the body.⁶ Hence; we evaluated the pre-dialysis and post-dialysis mean values of serum renal biochemical markers in CRF patients undergoing dialysis to elucidate the effect of dialysis on CRF patients.

MATERIAL AND METHODS

The present study was conducted in renal failure patients who were on dialysis in the age group of 18 to 65 years consisting of males and females. Study was conducted before and four hours after haemolysis. Samples were collected from the Satya Kidney institute in Hyderabad. 18 normal individuals whose renal parameters were within normal limits and with no history of renal impairment in the past were also selected between the comparable age group. Ethical approval was taken from the ethical committee and written consent was obtained after explaining them the entire research protocol. About 10 ml of venous blood without any anticoagulant was collected into sterile clean and dry polypropylene tubes to avoid contamination. Haemolysis is avoided, blood was allowed to clot. The serum after separation was centrifuged and transferred into sterile, clean and dry polypropylene tubes. The tubes were labelled and stored in refrigerator at - 20 degree centigrade. Within one week to 10 days of sample collection, serum copper and zinc were estimated by atomic absorption spectrophotometer (AAS). Other biochemical tests were done on the same day or next day. Measurement of blood urea was done by Diacetyl monoxime method. Serum creatinine was estimated by colorimeter using Jaffe's alkaline picrate method. Serum sodium and potassium were estimated by flame photometer. Serum calcium was estimated by titration method using ethylene diamine tetracetic acid. Serum phosphate was estimated by colorimeter using Fiske and Subbarow method. Assessment of the results were done with SPSS software. Chi square test and one way ANOVA were used for the assessment of level of significance.

INTRODUCTION

A slowly progressive disease of the kidney function progressing over a period of months and years to chronic renal failure (CRF).¹ It is characterized by low glomerular filtration rates (GFR). Severe illness is characterized in CRF and special replacement therapy of renal system such as dialysis is required for its treatment.² The incidence rate of CRF included 1 of every 5000 and affects mostly middle-ages and older people. Mostly irreversible, it might eventually leads to total kidney failure.^{3,4}

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RESULTS

Figure-1 highlights the mean values of serum and haematological parameter in control group, pre-dialysis group and post-dialysis group. Table 1 shows the p-value for the mean values of haematological parameters in control group, pre-dialysis group and post-dialysis group. Following results were obtained.

Blood urea levels: The blood urea values in pre-dialysis group were significantly higher (p-value < 0.05). The blood urea level in post-dialysis group was significantly lower.

Serum creatinine: Serum creatinine values in pre-dialysis group were significantly higher in comparison with the post-dialysis group (p-value < 0.05).

Serum potassium: Serum potassium values in pre-dialysis group were lower in comparison with the post-dialysis group (p-value < 0.05).

Serum sodium: Serum sodium levels in pre-and post-haemodialysis patients were lower in comparison with the controls.

Serum Zinc: Serum zinc levels in pre- and post-dialysis group were lower in comparison with the control group. However, in comparison with the pre-dialysis group, mean values of the post-dialysis group were lower.

Serum copper: Serum copper value in both the pre-dialysis and post-dialysis group was significantly lower in comparison with the control group (p-value < 0.05). However, the mean values in post-dialysis group were lower in comparison with the pre-dialysis group.

Serum calcium: Serum calcium levels in post-dialysis group were higher in pre-dialysis group (p-value < 0.05). Serum calcium levels in pre-dialysis group were lower.

Serum Phosphorus: Serum phosphorus levels in pre-dialysis group were statistical significantly higher in comparison with the post-dialysis group (p-value < 0.05).

DISCUSSION

One of the progressive diseases causing irreversible fall in the glomerular filtration rate further resulting in elevation in values of serum creatinine and blood urea nitrogen values is the chronic renal failure.⁷ Hypertension, diabetes mellitus, autoimmune cause etc forms the most common cause of chronic renal failure. Since it is irreversible in nature and progresses to further severe form with time, with a decline of glomerular filtration rate to 5 to 10 percent with high levels of uremia.⁸ These biochemical changes of the blood reflect the sign and symptoms of the disease. By measuring the serum level so the compounds excreted by the kidneys, assessment of the renal excretory functions can be done and therefore serum levels of electrolytes in the body fluids such as that of sodium, potassium etc can also be used as a diagnostic tool in assessment of renal diseases.^{9,10} Hence; we evaluated the pre-dialysis and post-dialysis mean values of serum renal biochemical markers in CRF patients undergoing dialysis to elucidate the effect of dialysis on CRF patients.

We noticed that in the present analysis, pre-dialysis group showed an increase in the levels of the urea and creatinine which were statistically significant (p-value < 0.05) (Figure 1, Table 1). This is due to the fall in the GFR in CRF patients. As the GFR falls, plasma levels of creatinine and urea rise as they are eliminated by glomerular filtration and tubular secretion. Blood urea and serum creatinine levels in the post-dialysis group showed a significant fall in comparison with the pre-dialysis group. In the present study, serum sodium levels in the pre-dialysis group are lower than the control group and are statistically non-significant (p-value > 0.05). The post-dialysis group showed a marginal increase. Also, serum levels of zinc in both pre-dialysis and post-dialysis groups were lower and were statistically significant. In comparison to pre-dialysis group, post-dialysis group showed slight increase in the serum zinc levels (Figure 1, Table 1). Seethalakshmi et al compared the salivary urea levels and levels of other serum biochemical parameters in patients with end stage renal disease at pre and post- dialysis stage. They analyzed patients who underwent haemodialysis because of renal failure. They assessed 30

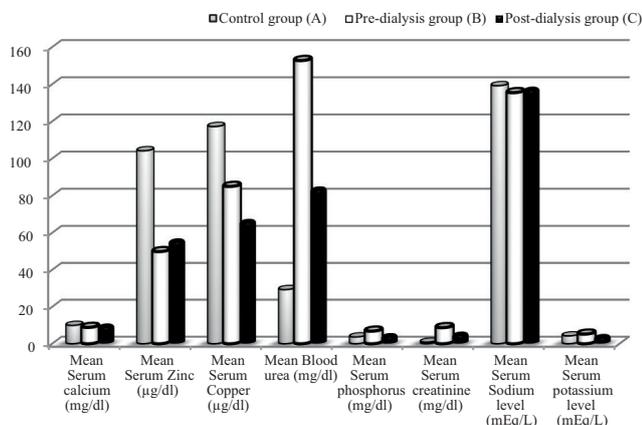


Figure-1: Mean values of serum and haematological parameter in control group, pre-dialysis group and post-dialysis group

Parameter	Control group (A)	Pre-dialysis group (B)	Post-dialysis group (C)	p-value B vs. C	p-value A vs. B	p-value A vs. C
Mean Serum calcium (mg/dl)	9.9	8.85	9.3	0.01*	0.01*	0.01*
Mean Serum Zinc (µg/dl)	104.16	49.9	55.4	0.01*	0.01*	0.01*
Mean Serum Copper (µg/dl)	117.22	85.00	65.88	0.01*	0.01*	0.01*
Mean Blood urea (mg/dl)	29.3	152.76	83.36	0.01*	0.01*	0.01*
Mean Serum phosphorus (mg/dl)	3.63	6.8	4.1	0.01*	0.01*	0.01*
Mean Serum creatinine (mg/dl)	0.8	8.7	4.9	0.01*	0.01*	0.01*
Mean Serum Sodium level (mEq/L)	139.2	135.48	137.04	0.14	0.01*	0.01*
Mean Serum potassium level (mEq/L)	4.2	5.2	3.6	0.01*	0.01*	0.01*

*: Significant

Table-1: p-value for the mean values of serum and haematological parameter in control group, pre-dialysis group and post-dialysis group

patients and collected venous blood prior to dialysis and after the process of dialysis. They collected the samples from the patients and immediately transferred the specimens to the laboratory for complete assessment of urea, creatinine, sodium, potassium and phosphate through an automated biochemical analyser. They observed statistical significant difference when results were assessed by paired t – test analysis. From the results, they concluded that in chronic dialysis patients, routine biochemical work using blood might be performed by keeping under observation of salivary parameters at shorter instances of time.¹¹ Cheng et al explored the changes occurring in the salivary urea, creatinine, and uric acid before and after haemodialysis in patients with end-stage renal disease. They evaluated salivary and serum levels of Urea, Cr, and UA of dialysis patients and measured by biochemical analyzer. They observed that in renal disease patients highly correlation exists in dialysis patients regarding various biochemical parameters. From the results, they concluded that similar clearing effect of salivary and serum Urea, Cr, and UA level is observed in renal disease patients.¹² Rodríguez-Carmona et al performed an exploratory analysis of serum irisin levels in patients undergoing different CKD (Chronic kidney disease) treatments. From the results, they concluded that in patients with CKD, serum irisin levels are low showed an association between GFR and plasma bicarbonate levels.¹³ Kritmetapak et al examined the correlation of biochemical parameters in relation to renal diseases. From the results, they concluded for the survival of the patients, DPI is a good indicator.¹⁴ Mohiuddin et al observed no significant association between Vitamin D levels with immune response to hepatitis B vaccine in their study.¹⁵

CONCLUSION

Under the light of above results, the authors hypothesized that in uremic patients, decrease absorption of calcium occurs. The post-dialysis serum concentration of sodium and calcium depend upon the dialysate composition of these elements and also serum which is available for ultra-filtration.

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