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Original Research Article

To Correlate the Association of Markers of Chronic Renal Failure in Patients With and without Haemodialysis

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Abstract: Chronic kidney disease is a worldwide public health problem with an increasing incidence and prevalence, poor outcomes, and high cost. Outcomes of chronic kidney disease include not only kidney failure but also complications of decreased kidney function and cardiovascular disease. Current evidence suggests that some of these adverse outcomes can be prevented or delayed by early detection and by haemodialysis. The aim is to study and correlate the markers of chronic renal failure in patients undergoing with haemodialysis and without haemodialysis. The study consist of total 35 subjects as healthy controls, 35 as chronic renal failure without haemodialysis and 35 as chronic renal failures undergoing haemodialysis from last 5 months and more. Biochemical parameters studied were serum total cholesterol, triglyceride, urea, creatinine, Na^+ and K^+. In the studied parameters, serum triglycerides, urea, creatinine, potassium were found to be significantly ($p<0.01$) increased in CRF without haemodialysis, but after haemodialysis these parameters were found to be normal except serum triglycerides, which was increased even after haemodialysis. No significant difference was seen in total cholesterol and sodium levels in studied groups ($p>0.05$). Chronic renal disease is accompanied by characteristic abnormalities of lipid metabolism, which appear as a consequence of nephrotic syndrome or renal insufficiency and are reflected in an altered urea, creatinine and potassium as well as elevated plasma triglyceride levels. Thus there is a correlation between the progression of renal disease and dyslipidemia. High triglyceride serum levels have been demonstrated to be independent risk factors for progression of renal disease in humans.
Keywords: Haemodialysis, Chronic Renal Failure, Urea, Creatinine, Cholesterol, Triglyceride, Sodium and Potassium

INTRODUCTION

Chronic renal failure refers to a condition where one or both kidneys lose their normal functionality, which may be due to different inducing factors i.e. bacterial infections, auto immune diseases, diabetes and other endocrine disorders, cancer, and toxic chemicals. It is characterized by the reduction of both glomerular and tubular functions of the kidney [1]. Chronic renal failure is single most important risk factor which can lead to end stage of renal disease [2]. CRF also can lead to one or more other known complications such as coronary heart diseases, anaemia or pericarditis [3, 4].

As chronic renal failure is progressive and irreversible in nature, and progressively it lead to the end stage renal disease (ESRD), at which glomerular filtration rate is around 5-10% and there is a high level of urea causing uremia. Most of the signs and symptoms of the disease reflect this biochemical changes in the blood [5]. It is been observed that, there is high prevalence coronary heart diseases (CHD) in CRF patients; it might be due to consequent dyslipidemia. This dyslipidemia has capacity to cause renal insufficiency [6].

In healthy persons, the kidneys are involved primarily in removing waste products and fluids from the blood stream, which are generated during metabolism and excreting them in the urine, also the kidneys maintain the body's internal homeostasis of water and minerals (sodium, potassium, chloride, calcium, phosphorus, magnesium and sulphate etc). Haemodialysis is an alternative used in medicine when patients have suddenly lost their kidney functioning (acute renal failure) or for stable patients who have permanently lost their kidney functioning (end stage renal failure) [7].

Haemodialysis is a method that is used in CRF patients, in this technique the extracorporeal removal of waste products such as creatinine, urea and free water from the blood by an artificial machine when the kidneys are not in a state of normal functioning. It corrects electrolytes balance by dialyzing the patient's blood against fluid containing no urea but has levels of rest of minerals like sodium, potassium and calcium that are similar to their natural composition in healthy blood [8]. In medicine, haemodialysis is an alternative i.e. renal replacement therapy which is used to provide an artificial replacement for lost kidney function due to renal failure. Thus, it is a life support in the absence of kidney function and does not treat any kidney diseases [9].

The objective of this study is to find out the biochemical changes (Total cholesterol, Triglyceride, urea, creatinine, Na^+ and K^+) in patients with chronic renal failure undergoing haemodialysis and without dialysis and compare the obtained results with the results of healthy individuals as control groups.

AIMS AND OBJECTIVES OF THE STUDY

The aim of this study is to compare some serum biochemical parameters in chronic renal failure undergoing haemodialysis with healthy controls. Objective is to prove that the chronic renal failure is associated with significantly high deranged biochemical parameters and role of haemodialysis method as possible alternative to lost renal functions.

MATERIALS AND METHODS

Study groups and sample collection

The present study was carried out in the Dept. of Biochemistry and Central Clinical Lab Biochemistry section, in Pad. Dr. Vithalrao Vikhe Patil foundation's Medical College and Hospital, Ahmednagar. The patients selected for the present study were attending indoor/ out-door patient department or those undergoing haemodialysis due renal failure of any cause. The clinical checkups of the patient were done by physicians on the basis of detailed clinical history and clinical examination. The total numbers of subjects were 70 (either male or female patients having age in between 20-65 years). 35 healthy individuals were taken as healthy control. The venous blood was collected from the study group and control group. The collected samples were immediately (within 15 min) handed over to the laboratory for the biochemical examination of total cholesterol, triglyceride, urea, creatinine, Na^+ and K^+ by an automated biochemical analyser. The ethical committee of the Hospital and Medical College approved the research project work and all the patients have given written informed consent.

Measurement of different biochemical parameters

Estimation of total blood cholesterol

The cholesterol estimation was done by CHOD- PAP enzymatic end point assay method (SPAN). Cholesterol esters were hydrolysed by cholesterol esterase (CE) to give free cholesterol and fatty acids. In subsequent reaction, cholesterol oxidase (CHOD) oxidises the 3-OH group of free cholesterol to liberate cholest-4-en-3-one and hydrogen peroxide. In presence of peroxidise (POD), hydrogen peroxide couples with 4-aminoantipyrine (4-AAP) and phenol to produce red quinoneimine dye. Absorbance of coloured dye is measured at 505 nm and is proportional to amount of total cholesterol concentration in the sample.

Estimation of blood triglycerides

The triglycerides estimation was done by GPO- PAP, end point assay method (SPAN). Triglycerides were hydrolysed by lipoprotein lipase (LPL) to produce glycerol and free fatty acids (FFA). In presence of glycerol kinase (GK), ATP phosphorylates glycerol to produce glycerol 3-phosphate and ADP. Glycerol 3-phosphate is further oxidised by glycerol 3-phosphate oxidase (GPO) to produce dihydroxy acetone phosphate (DAP) and H_2O_2. In presence of peroxidase (POD), hydrogen peroxide couples with 4-aminoantipyrine (4-AAP) and 4-chlorophenol to produce red quinoneimine dye. Absorbance of coloured dye is measured at 505 nm and isproportional to amount of triglycerides concentration in the sample.

Estimation of blood urea

For blood urea estimation we followed NED-dye, initial rate assay method (SPAN). Urea condenses with O–phthaldehyde and naphthyl ethylene diamine (NED) to form coloured complex. The rate of formation of this complex is directly proportional to urea concentration in the sample and is measured in an initial rate (fixed time) mode at 505 nm.

Estimation of blood creatinine

For blood creatinine we followed picrate method (SIEMENS). Creatinine in alkaline solution reacts with picrate to form a red-orange compound. Under the specific conditions of the assay, the rate of development of the colour was proportional to creatinine concentration in the sample when measured at 500 nm.

Estimation of Na^+ and K^+

The sodium and potassium of human serum samples was determined was by 9180 electrolyte analyser supplied by Roche. For this we followed manufacture manual.

Statistical Analysis

All the biochemical parameters were evaluated and were statistically compared. The analysis of data was done on Graph Pad software. Also data were expressed in mean ± Standard Deviation form.

Probability values < 0.05 were considered as significant.

RESULTS

Table 1: Biochemical Analysis

Parameters	Healthy controls	CRF without HD	CRF under HD
Total cholesterol (mg/dl)	172 ± 12	175 ± 30	181 ± 23
Triglycerides (mg/dl)	130 ± 18	211 ± 8.0**	245 ± 21**
Urea (mg/dl)	28.1 ± 7.31	142 ± 43.41**	93.01 ± 35.17**
Creatinine (mg/dl)	0.81 ± 0.30	12.48 ± 2.89**	6.32 ± 3.01**
Na+ (mmol/L)	140 ± 4	139 ± 3.2	142 ± 5.1
K+ (mmol/L)	4.30 ± 0.64	5.52 ± 2.61**	3.98 ± 0.39**

*p<0.05 * *p<0.01. CRF= chronic renal failure, HD= Haemodialysis.

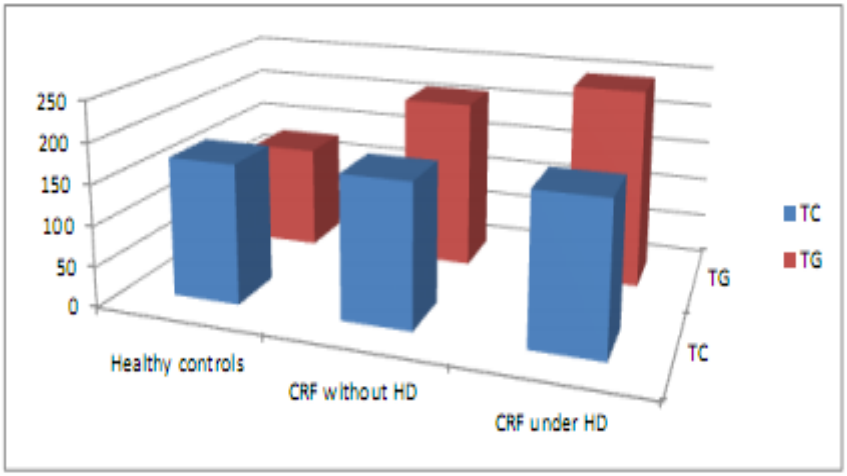

Fig-1: Measurement and comparison of total cholesterol and triglycerides levels in different study groups. Each bar represents Mean ± SD

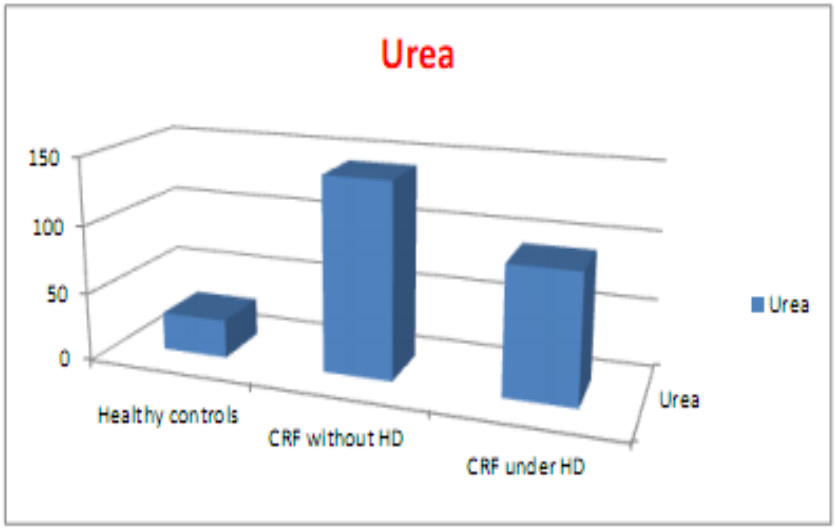

Fig-2A: Measurement and comparison of blood urea levels in different study groups, Each bar represents Mean ± SD

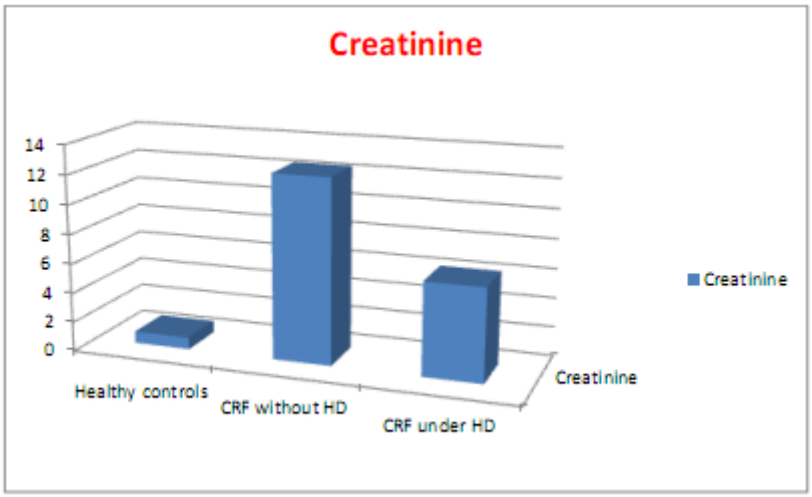

Fig-2B: Measurement and comparison of blood creatinine in different study groups. Each bar represents Mean ± SD

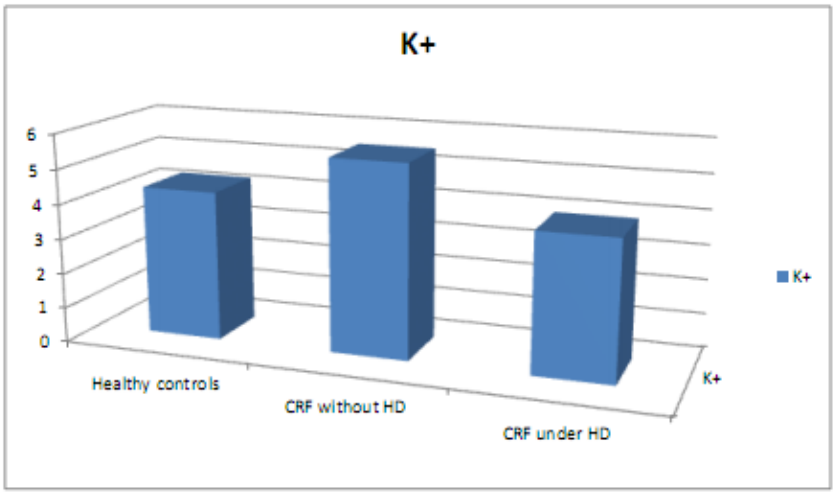

Fig-3: Measurement and comparison of serum potassium levels in different study groups. Each bar represents Mean ± SD

DISCUSSION

All the biochemical parameters were evaluated and compared in three groups, first was 35 healthy control subjects, second was of CRF patients(35 subjects) who had not undergone haemodialysis and third was of CRF patients(35 subjects) on haemodialysis (three times per week for more than five months).

From-Table 1, Figure 1, Among three groups, triglycerides level was significantly high in CRF without haemodialysis ($p<0.01$) as compared to healthy controls, whereas it is still high in CRF with haemodialysis (even more than second group) ($p<0.01$) as compared to healthy controls. There was no significant rise or fall in total cholesterol levels in above three groups ($p>0.05$).

From-Table 1, Figure 2. The renal panel i.e. blood urea and creatinine levels were within normal limits in healthy controls, whereas their concentrations were significantly high in CRF without haemodialysis ($p<0.01$) and CRF with haemodialysis ($p<0.01$) as compared to healthy controls. When compared in second and third groups of patients, urea and creatinine in CRF with haemodialysis showed much decreased levels as compared to CRF without haemodialysis.

Table 1, Figure 3, Among three groups, mean serum sodium level in CRF without haemodialysis was surprisingly lower than CRF with haemodialysis, but there was no significant difference in all groups ($p>0.05$). However, the mean level of serum potassium was significantly high in CRF without haemodialysis ($p<0.01$) and was decreased significantly after haemodialysis ($p<0.01$).

In the present study, we did not found any significant change in total cholesterol levels in study groups ($p>0.05$), moreover the values remain normal or

decreased in CRF with or without haemodialysis. Regarding triglycerides level, we observed that there was highly significant rise in CRF without haemodialysis, still more high level to this second group was found in CRF with haemodialysis ($p<0.01$) as compared to healthy controls. Different studies also shown that hyper triglyceridemia is very well there in CRF patients with or without haemodialysis [10-12]. It has been said that hyper triglyceridemia in CRF patients is due to decreased activity of lipoprotein lipase and increased triglyceride synthesis by liver from free fatty acids released from fatty tissue [13].

The very important and primary function of kidney is to excrete metabolic waste product, urea being waste product of protein metabolism, whereas creatinine is waste product from muscle tissue. Both these metabolic waste product are excreted mainly from kidneys, so obviously in kidney failure levels of both will rise [14]. In the present study also we found significant rise in serum urea and creatinine level suggesting malfunctioning of kidneys. It was corrected upto certain level by haemodialysis as seen in present study.

The mean serum sodium levels in CRF with haemodialysis group were found to be slightly more than levels in CRF without haemodialysis group patients. The result we found here was consistent with some other studies [15-17]. whereas mean serum potassium level in CRF with haemodialysis was significantly low compared to mean value of serum potassium in CRF without haemodialysis patients, suggesting recovery during haemodialysis. This result was also consistent with some other studies [16-19].

Haemodialysis is an effective treatment modality in most chronic renal failure patients and end stage renal disease patients. Thus it forms an alternative to renal transplantation. Adequate haemodialysis has prolonged the survival of CRF and ESRD patients improving quality of life. Cardiovascular disease was found to be the most frequent cause of mortality in majority of patients on maintenance haemodialysis [20].

CONCLUSION

Thus, from present study it is be shown that, blood total cholesterol, serum sodium does not have significant variation in healthy controls, CRF with or without haemodialysis. Whereas remaining biochemical parameters studied i.e. triglycerides, urea, creatinine and potassium levels were found to be significantly raised in CRF without haemodialysis, as compared to healthy controls. After haemodialysis these parameters i.e. urea, creatinine and potassium get decreased significantly, but only triglycerides was found to be raised significantly even after haemodialysis, suggesting dyslipidemias in CRF patients.

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