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The Biochemical Profile of Chronic Kidney Disease Patients.

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ABSTRACT

Chronic kidney disease-CKD is a major public health problem and cause of morbidity and mortality worldwide. In Pakistani population, the prevalence of CKD is unexpectedly high therefore not unexpected since incidence of hypertension and diabetes in Pakistani population is one of the highest in the world. CKD is defined as impaired glomerular filtration rate (GFR) or elevated albumin excretion in the urine, and has been recognized as an important risk factor contributing to cardiovascular disease and death. The most common risk factors for CKD includes; diabetes mellitus, hypertension, dyslipidemia and most important older age, but the clinical implications still remain uncertain in elderly persons suffering from CKD. The present study aims to evaluate the biochemical profile in the patients with chronic kidney disease as compared to the healthy controls. Analysis of lipid profile (Cholesterol, Total Lipid, HDL-C, LDL-C, and Triglycerides), renal profile (Urea, Creatinine, BUN and Uric acid), Electrolytes (Sodium, Potassium, Chloride and Bicarbonate) and Hematological indices were carried out in CKD patients (n=50) as compared to the healthy individual (n=50) by using Automated and standardized kit methods. We suggests the use of stringent hematological and biochemical testing such as lipid and renal profile in the patients suffering from Chronic kidney disease, for correct diagnosis and more accurate treatment strategy to decrease morbidity and mortality related with CKD.

Keywords: Chronic Kidney Disease (CKD), Lipid profile, Renal profile, Hematological profile.

INTRODUCTION

According to the survey conducted in 2011 in Karachi - a city harboring 9% of Pakistan's population (>30 years of age), an astonishing 25.3% had some degree of reduced glomerular filtration rate (GFR), with 5% having moderate CKD (GFR <60 ml/min/1.73m^2). Even more disturbing was the fact that only 2.3% individuals were aware of having renal disease, most people with lower income falling in to this category (Zeb *et al*., 2012; Jafar *et al*., 2005; Couser *et al*., 2011).

CKD is defining as a progressive loss in renal function over a period of months or years, having non-specific symptoms of worsening kidney function. The risk factors for chronic kidney disease include an age more than 60 years, hypertension, diabetes, cardiovascular disease and a family history of CKD (Peter, *et al*., 2007). Moreover, the structural and functional changes in the kidneys have been associated with the ageing process, the kidneys atrophy and the cortical thickness decreases by approximately 10% per decade after the age of 30 years may lead to kidney scarring (Hsieh, 2009).

The diagnosis for CKD is based on the screening of peoples known to be at risk such as those with high blood pressure or diabetes, first degree blood relatives,

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suffering from chronic kidney disease. It may also be identified in case of cardiovascular disease, anemia or pericarditis, which may be one of its recognized complications (LeeAnn *et al*., 2012; Levin, 2003). The markers of renal function tests such as urea, uric acid, creatinine, BUN and electrolytes were used to assess the normal functioning of kidneys. The increase or decrease values of these biomarkers were indicating the glomerular filtration rate and the tubular function (concentrating and diluting capacity) of kidneys or simply the dysfunction of kidney (Shivaraj *et al*., 2010; Eiichiro *et al*., 2013; Ian Wu and Parikh 2008).

Hsieh *et al*., (2009) have reported that the electrolyte abnormalities such as hyponatremia, hypernatremia, hyperkalemia and hypokalemia are the most observed changes in the renal and cardiac functions, especially in the advanced age make them prone to chronic kidney disease. The management of electrolyte abnormalities is often complex, especially due to the adverse effects the numerous drugs and co morbidities that often present in CKD patients. It has been suggested that hyperlipidemia could cause renal injury and contribute to the progression of renal disease. There have been a number of observational studies showing that lipid abnormalities are associated with a reduction in kidney function in the general population (Wanner and Ritz, 2008). Although some studies demonstrated that cardiac related cause of death in patient with CKD are not all directly related with atherosclerotic process but most probably related to arrhythmia, are extremely common causes of death in all stages of CKD (Hsieh 2011). Furthermore, in the general population sudden death is most commonly due to coronary artery disease but there are less clear data on the mechanism of sudden death in CKD.

Hematological disturbance such as anemia is considered as a frequent complication occurs in chronic kidney disease and is associated with morbidity and mortality and a decline in quality of life. The severity of anemia is directly proportional to the degree of renal function (Kalantar *et al*., 2009).

The present study aims to evaluate the biochemical profile in chronic kidney disease patients as compared to normal healthy controls.

MATERIALS AND METHODS

The present study was designed to evaluate the alterations in the biochemical profile in serum samples of chronic kidney disease patients (n=50), who were referred as the out patients from different kidney and Urology clinics and hospitals from all over Karachi-Pakistan.

The analysis of lipid profile (Cholesterol, Total Lipid, HDL-C, LDL-C, and Triglycerides) and renal profile (Urea, Creatinine, BUN and Uric acid) were measured by using chemistry analyzer (STAT Lab 300 Plus). The serum electrolytes (Sodium, Potassium, Chloride and Bicarbonate) were estimated by Flame photometer (Jenway Clinical PFP7C) and hematological indices using hemato-analyzer, in chronic kidney disease patients as compared to the apparently healthy and non smoking subjects(n=20) were selected at random.

Statistical analysis was performed using standard statistical software (SPSS version 16.0). All data are expressed as mean ± SD. The data were also tested using student's t-tests; the significance level was set as $p < 0.05$.

RESULTS

The characteristics lipid profile was reported in Table I suggesting significant ($p<0.0001$) increase in the level of triglyceride (26%) in CKD patient as compared to the normal controls. Significant ($p>0.001$) decrease of about (14%) was observed in cholesterol concentration of patient with CKD however, the levels of HDL-C was observe to be decrease (48%) significantly while no change in the level of LDL-C in the patients suffering from CKD with reference to normal controls. The levels of total lipids were also found to be significantly increased in CKD patients as compared to the normal group.

Table I: Lipid profile of CKD patients Vs Controls.

Parameter	Cholesterol mg/dl	HDL-C mg/dl	LDL-C mg/dl	TG mg/dl	Total-Lipid mg/dl
Control (n=20)	199.55+12.8	70.75+6.04	102.90+21.3	98.50+7.68	506.90+94.7
Samples (n=50)	170.46+51.01*	36.75+11.5*	104.02+38.4	131.0+47.9*	641.1+200.5*
P values	0.0144	0.0001	0.9027	0.0037	0.0056

Table II: Renal profile of CKD patients Vs Controls.

Parameter	Urea mg/dl	Creatinine mg/dl	Sodium mg/dl	Potassium mg/dl	Chloride mg/dl	Bicarbonste mg/dl
Control (n=20)	26.5+5.65	1.053+0.26	138.5+3.39	4.10+0.411	104.9+3.54	24.46+2.48
Samples (n=50)	72.45+38.50*	4.87+3.642*	139.6+5.13	4.54+0.92*	110.3+6.28*	18.2+3.93
P values	0.0001	0.0001	0.2219	0.0.0026	0.0001	0.0001

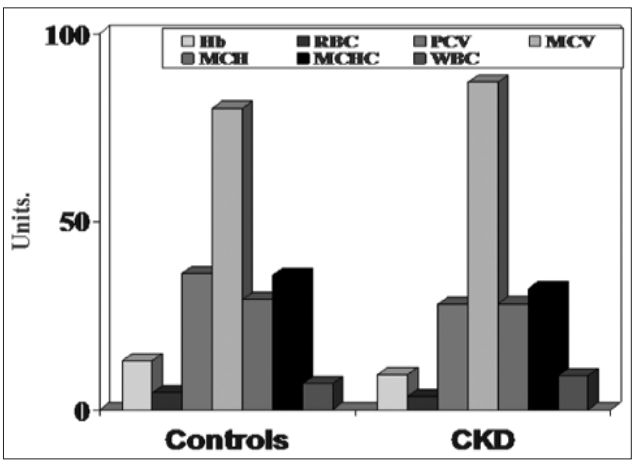

Figure 1: Comparison of hematological profile in CKD patients Vs Normal controls.
Hb- hemoglobin (g/dl), RBC- Red blood cell concentration (103/mm2), PCV-Packed cell volume (%), MCV-Mean cell volume (fl), MCH-Mean cell hemoglobin (pg), MCHC- mean cell hemoglobin concentration (%),WBC-White blood cell concentration (103/mm2).

Table II illustrates the renal profile comprising the levels of urea, creatinine and electrolytes (Sodium, Potassium, Chloride and Bicarbonate) in serum samples of CKD patient as compare to the normal controls. Significant ($p<0.0001$) increase was observed in serum urea, and creatinine (63.43%, 78.48% respectively) in CKD patients as compared to the normal controls. However, Slight but Significant ($p<0.025$, $p<0.0001$respectively) changes was observed in potassium (9.7%↑) and chloride (4.91%↑) with insignificant slight increase in sodium (0.77 %↑) ions. However, significant ($p<0.0001$) decrease was observed only in the level of serum bicarbonate (34.1 %↓) concentration in chronic kidney disease patient as compared to normal controls.

Figure-1 depicts the Comparison of hematological profile in CKD patients as compared to normal controls. Significant ($p>0.0001$) decrease was observed in both hematological indices such as (RBCs count and Hb concentration) and in absolute indices such as (PCV, MCH and MCHC) levels in CKD patients while the MCV did not show any significant difference in CKD patients as compared to healthy controls.

DISCUSSION

In CKD patients, our results shows that they exhibit atherogenic lipid profile which is characterized by an increase serum level of total lipid and triglycerides as compared to the normal controls (Table-I) suggesting that the triglyceride concentration is high due to down regulation of lipoprotein lipase (LPL), hepatic lipase, very low density lipoprotein (VLDL) and low density lipoprotein receptor (LDL-r) expression, lead to the main dyslipidemia disturbance in these CKD patients (Silva LS *et al*., 2012; Khedidja 2009; Piecha *et al*., 2009; Keane 2013). In CKD patients (Table-II), the increased concentration of urea, creatinine and Electrolytes was observed suggesting their association with inflammatory and malnutrition condition. This increase in the concentration of urea and creatinine could lead to proteinuria, hematuria and renal dysfunction, as observed in high percentage in CKD patients as compared to normal healthy individuals (Thomas *et al*., 2008; Amin-ul-Haq *et al*., 2010; Alcázar, 2008).

In CKD patients, the observed hematological disturbances like decrease in RBC count, hemoglobin concentration, packed cell volume and leukocyte count suggesting anemia (Figure-1). Changes in red cell indices are due to a number of factors aside erythropoietin productions, deficiencies of iron, vitamin B12 and folate as a result of nutritional insufficiency or due to increased blood loss are contributory factors. The impaired erythropoietin because as high as 90% of erythropoietin is produced in the juxta glomerular apparatus of the kidney while 10% are produced in the liver and other organs. The severity of affects depends on the stage of renal failure (George *et al*., 2009; Guenter *et al*., 2005)

We suggests the use of stringent hematological and biochemical testing such as lipid and renal profile in the patients suffering from Chronic kidney disease, for correct diagnosis and more accurate treatment strategy to decrease morbidity and mortality related with CKD.

CONCLUSION

We conclude that multiple factors are involved in the progression of kidney disease in our population including the most frequent use of contaminated water, unhygienic food stuff (vegetables), rampant lack of awareness, under-detection of earlier stages of CKD, lack of preventive measures etc. all of them inevitably facilitates progression of mild, potentially treatable CKD to full-blown kidney failure. It is not surprising that only 10% of kidney failure patients receive any renal replacement therapy due to the unaffordable treatment cost. There is a dire need to stress on the national and international programs aimed to prevent and control CKD in third-world countries such as Pakistan.

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