Biochemical evaluation of creatinine in patients with chronic renal failure

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ABSTRACT

Introduction: Chronic renal failure is a progressive reduction in renal function. The kidneys lose their normal function, especially the excretory and regulatory functions which can be due to infections, autoimmune diseases, hypertension, cancer, diabetes, and toxic chemicals. The goal of this study is to estimate the serum creatinine levels in patients with chronic renal failure. Materials and Methods: A total of 50 patients who were diagnosed in kidney care center for renal failure based on their clinical history, clinical examinations, and renal function tests were randomly evaluated. Biomarker levels of serum creatinine before and after the hemodialysis session were screened. The creatinine levels in the samples were assessed by Jaffe Kinetic assay (22, 2002). Results: Serum creatinine level was significantly higher than normal range (up to 1.4 mg/dl) in renal failure patients undergoing dialysis (P < 0.005). Discussion: Renal failure is a gradual, progressive, and irreversible loss of normal functioning of kidneys. Increased levels of creatinine excretion in blood by impaired kidneys made complication in patients with renal failure before hemodialysis. Conclusion: Increase in serum creatinine level leads to chronic renal disease which can further lead to various complications such as hypertension and cardiovascular diseases.

KEY WORDS: Chronic renal failure, Creatinine, Hemodialysis, Jaffe kinetic assay

INTRODUCTION

Renal failure is a systemic disease causing kidney and urinary tract infections. Chronic kidney disease (CKD) is a progressive reduction in renal function. The kidneys lose their normal function, especially excretory and regulatory functions which can be due to infections, autoimmune diseases, diabetes, hypertension, cancer, and toxic chemicals. CKD is heading toward becoming a major health problem and is rapidly assuming epidemic proportions worldwide. Serum urea and creatinine are most widely accepted parameters to assess CKD status as well as to assess renal status in susceptible diabetic and hypertensive subjects.

The most common causes of chronic renal failure are diabetes mellitus type 1 or 2 diabetes and high blood pressure. Common cause of end-stage renal failure worldwide is IgA nephropathy. Diabetes or high blood pressure can lead to damage of small blood vessels in the body. The blood vessels in the kidneys also get damaged, resulting in CKD.

Creatinine is a breakdown product of creatine phosphate in muscle and its production is proportional to muscle mass. Majority of creatinine is filtered by the glomerulus. It is also secreted by proximal tubular cells. Concentration of creatinine in plasma is influenced by muscle mass of patients.

Creatinine tests diagnose impaired renal function and measure the amount of creatinine phosphate in blood. Urea and creatinine are good indicators of a normal functioning kidney and their increase in the serum is indications of kidney dysfunction. Serum creatinine is widely accepted and one of the most common parameters in assessing renal functions. Collection of blood for serum analysis is an invasive technique causing anxiety and discomfort to patients due to blood loss from frequent blood sampling and thereby increases the risk for patients as well as health-care professionals to blood-borne diseases. Males have higher serum creatinine levels than females due to greater muscle mass in males. The quantity of creatinine in serum depends on their generation, glomerular filtration, and tubular secretion.
Calculations based on serum creatinine and the age groups of the patient are used to estimate the degree of kidney function more precisely. Neither creatinine nor urea is directly toxic. They are just substances used to measure kidney function. Creatinine is produced in the muscles by the non-enzymatic changes of creatine and phosphocreatine. The liver has a significant role in the assembly of creatinine through methylation of guanidine aminoacetic acid. The normal serum creatinine level is 0.5–1.0 mg/dL according to diurnal and menstrual variations, pursuit, and diet. This study deals about the estimation of creatinine in patients with chronic renal failure.

**MATERIALS AND METHODS**

A total of 50 patients who were diagnosed in kidney care center for renal failure based on their clinical history, clinical examinations, and renal function tests were randomly evaluated.

**Sample Collection**

Informed consent will be obtained from the patients before sample collection. Blood was collected 3 h after lunch approximately at 4 PM. About 3 ml of venous blood will be collected and distributed in plain collection tubes and centrifuged in 3000 rpm for serum. Then, serum will be separated and analyzed to estimate the cortisol by enzyme-linked immunosorbent assay using ROBONIK, ELISA READER. Biomarker levels of serum creatinine before and after the hemodialysis session were screened.

**Estimation of Serum Creatinine**

The creatinine levels in the samples were assessed by Jaffé Kinetic assay (22, 2002). Creatinine in the serum sample reacted with picric acid in an alkaline solution (i.e., alkaline picrate) of the reagent and developed an orange-colored complex. The quantity of creatinine in the test samples was calculated against the intensity of the color developed during the fixed time. The intensity of the color was measured using a fully automated Cobas C311 analyzer for the detection of serum creatinine.

**RESULTS**

Eight people belong to the age group of 21–40 years. Thirty people belong to the age group of 41–60 years and 12 people belong to the age group of 61–80 years [Table 1].

**DISCUSSION**

Renal failure is a gradual, progressive, and irreversible loss of normal functioning of kidneys. Increased levels of creatinine excretion in blood by impaired kidneys made complication in patients with renal failure before hemodialysis. Serum creatinine level was found to be significantly higher than normal range (up to 1.4 mg/dl) in renal failure patients undergoing dialysis ($P < 0.005$) [Figure 1].

Metabolic syndrome (MetS) is also one of the reasons for chronic renal failure. In MetS, the urea and creatinine levels are increased which can increase the risk of chronic renal failure. Change in thyroid status can cause renal damage and can lead to chronic renal disease. CKD may be closely related with non-alcoholic fatty liver disease. Increased serum creatinine levels can also lead to hypertension and cerebrovascular disease. Chronic renal failure patients may have oral manifestations such as increased gingival index and decreased saliva secretion. Their salivary calcium level of chronic renal failure patients will be normal, but the levels of urea, creatinine, and salivary phosphorus will be higher. Chronic renal failure changed from a subspecialty issue to a global health concern. The previous studies say that chronic renal failure is more prevalent in females than in males. During childhood, serum creatinine level increases due to increased muscle mass. Patients with smaller kidneys have higher serum creatinine levels.

**Table 1: Pre- and post-hemodialysis**

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Number of cases (n)</th>
<th>Serum creatinine levels (mg/dl)</th>
<th>Pre-hemodialysis</th>
<th>Post-hemodialysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>21–40</td>
<td>8</td>
<td>Mean±SD 11.4±3.06</td>
<td>t-test 9.547</td>
<td>Mean±SD 3.67±1.97</td>
</tr>
<tr>
<td>41–60</td>
<td>30</td>
<td>Mean±SD 12.3±3.23</td>
<td>t-test 17.55</td>
<td>Mean±SD 4.03±1.76</td>
</tr>
<tr>
<td>61–80</td>
<td>12</td>
<td>Mean±SD 9.27±2.60</td>
<td>t-test 10.55</td>
<td>Mean±SD 2.36±1.54</td>
</tr>
</tbody>
</table>

SD: Standard deviation

**Figure 1:** Graph showing pre-hemodialysis and post-hemodialysis
CONCLUSION

Increase in serum creatinine level leads to chronic renal disease. Chronic renal failure can also be due to hormonal imbalance and it can lead to several other diseases such as cardiovascular diseases and cerebrovascular diseases.

REFERENCES


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