Study on Alcohol Consumption and Renal Dysfunction

1Dr. Srinivas. K, 2Dr. Sumalatha Naitham, 3Dr Dasari Kamalakar, 4*Dr. Shyam Prasad. Parimala.

1,2,3 Assistant Professor , Department of General Medicine , RIMS , Adilabad, Telangana.

4* Assistant Professor, Department of Orthopedics, RIMS, Adilabad, Telangana.

Corresponding Author: Dr. Shyam Prasad. Parimala

Abstract

The kidney is an important organ having not only excreting function but also other functions such as production of the substances that activates a living body, enzymatic reaction, immunization etc. After ethanol administration, ethanol and its metabolites go through kidneys and are excreted into urine, and its content in the urine is higher than that of the blood and the liver. Chronic ethanol administration decreases the renal tubular reabsorption and reduces renal function. This study was conducted to examine the association of alcohol consumption with the change and rapid decline in kidney function. 25 adult patients who are moderate alcoholics, 25 patients who are severe alcoholics and 25 adult patients who are non-alcoholics were included in study. Blood Urea and Serum creatinine were investigated. These kidney function parameters were compared between alcoholic and non-alcoholic subjects. In our study Mean blood urea was 48.96 ± 14.62 in alcoholic subjects and 26.62 ± 10.12 in non alcoholic subjects and this difference was statistically significant p value 0.012. Mean serum creatinine was 1.17 ± 1.02 in alcoholic subjects and 0.68 ± 0.22 in non alcoholic subjects and this difference was statistically significant p value 0.017. This shows that moderate to severe alcohol consumption can decline Renal functions.

Keywords: Alcohol consumption, Renal function, Urea, Creatinine

Introduction

The kidney is an important organ having not only excreting function but also other functions such as production of the substances that activates a living body, enzymatic reaction, immunization etc. After ethanol administration, ethanol and its metabolites go through kidneys and are excreted into urine, and its content in the urine is higher than that of the blood and the liver. The kidney is often involved in the development, maintenance and counter regulation of complex electrolyte disturbances like phosphate and potassium hypoglycemia etc. (1). Some studies suggest that chronic ethanol ingestion per se is not nephrotoxic (2). The kidney seems to be the only vital organ generally spared in chronic alcoholics without advanced alcoholic liver disease or hepatorenal syndrome. But, regular alcohol consumption raises the blood pressure, which per se is a risk factor for renal damage. Large amounts of ethanol have deleterious effects on the kidney. Structural and functional abnormalities of the kidney are reported with increasing frequency in the fetal alcohol syndrome seen in children who have been prenatally exposed to ethanol (3,4).

Alcohol consumption has been a part of socio-cultural practices worldwide. According to the World Health Organization report in 2016, about 43% of the world’s population over 15 years old reported drinking in the past 12 months(5). According to the Korean National
Health and Nutrition Examination Survey (2013), the drinking rate of men and women was 75.3% and 45.7%, respectively (6). Alcohol consumption has various effects on health. Although its obvious adverse health effects include liver cirrhosis, cancers, seizure, pancreatitis, poisoning, etc., previous studies have reported that light to moderate alcohol consumption has some beneficial effects such as reduction in the risk of cardiovascular disease and type 2 diabetes (7-11). Kidney function, assessed by measurement of the glomerular filtration rate declines by about 8 mL/min/1.73 m² per decade after age 40 years (12). The decline in kidney function may be accelerated due to various factors such as hypertension, diabetes, primary renal disorders, and some medications causing kidney injury. It is a noteworthy problem that patients with impaired kidney function also consume alcohol. Previous studies have shown that about 20–36% of patients with chronic kidney disease (CKD) consume alcohol either occasionally or daily, and 10% of patients even drink heavily. Notwithstanding, the association between alcohol consumption and kidney function has received relatively less attention and studies have been inconclusive. Some studies reported that alcohol consumption was associated with the development or progression of CKD (13). In other studies, however, alcohol consumption was not associated with kidney function; rather, it was inversely associated with the risk of CKD (14–16). Hence, we sought to examine the association of alcohol consumption with the change and rapid decline in kidney function.

Material and Methods
A retrospective medical chart review was conducted for patients who sought treatment for alcohol use problems for a period of 1 year and healthy non-alcoholic subjects who visited laboratory for routine investigations. A detail history was taken in alcoholics about quantity, type of alcohol, and number of years of alcohol consumed. Name, age, gender, occupation, and socioeconomic status were noted. General and systemic examination was done.

Samples Size
• Twenty-five adult patients who are moderate alcoholics
• Twenty-five patients who are severe alcoholics and
• Twenty-five adult patients who are non-alcoholics.

Inclusion Criteria
• All adult patients who are moderate alcoholics that are who consume alcohol <80–90 mg alcohol which is about 11 drinks per day
• All adult patients who are severe alcoholics that are who consume more than 80–90 mg alcohol or more than 11 drinks per day
• 20–25 adult patients who are non-alcoholics taken as control

Exclusion Criteria
• All patients who are <18 years
• Patients with other hepatic disorders
• Patients receiving hepatotoxic drugs.
Following Renal function parameters, information of all subjects under the study was collected: Blood Urea and Serum creatinine. These kidney function parameters were compared between alcoholic and non-alcoholic subjects. All data were entered and analyzed using SPSS. Mean and standard deviation were derived for all parametric variables. Chi-square tests were applied for comparing discrete variables and ANOVA was applied for comparing continuous variables and P < 0.05 was considered as statistically significant.
Results

Table 1: Age group of study subjects.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Alcoholic subjects n = 50</th>
<th>Percentage</th>
<th>Non alcoholic subjects n = 25</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-40</td>
<td>18</td>
<td>36 %</td>
<td>7</td>
<td>28 %</td>
</tr>
<tr>
<td>41-60</td>
<td>27</td>
<td>54 %</td>
<td>14</td>
<td>56 %</td>
</tr>
<tr>
<td>60 and above</td>
<td>5</td>
<td>10 %</td>
<td>4</td>
<td>16 %</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100 %</td>
<td>25</td>
<td>100 %</td>
</tr>
</tbody>
</table>

36 % of alcoholics were in age group of 20-40 years. 54 % were in age group of 41-60 years. 10 % alcoholics were above 60 years age.

Table 2: Gender distribution of study subjects.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Alcoholic subjects n = 50</th>
<th>Percentage</th>
<th>Non alcoholic subjects n = 25</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>33</td>
<td>66 %</td>
<td>20</td>
<td>80 %</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>34 %</td>
<td>5</td>
<td>20 %</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100 %</td>
<td>25</td>
<td>100 %</td>
</tr>
</tbody>
</table>

66 % alcoholics were male and 34 % were female.

Table 3: Duration of Alcohol consumption.

<table>
<thead>
<tr>
<th>Duration in years</th>
<th>Number of subjects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>16</td>
<td>32 %</td>
</tr>
<tr>
<td>11-20</td>
<td>14</td>
<td>28 %</td>
</tr>
<tr>
<td>&gt;20</td>
<td>20</td>
<td>40 %</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>100 %</td>
</tr>
</tbody>
</table>

32% alcoholics had duration of alcohol consumption for 1-10 years. 28% had consumed alcohol for duration of 11-20 years. 40 % subjects had consumed alcohol for more than 20 years.

Table 4: Comparison of Kidney Function Test in Alcoholics and non alcoholics.

<table>
<thead>
<tr>
<th>Kidney Function Test</th>
<th>Alcoholic subjects n = 50 Mean ± SD</th>
<th>Non alcoholic subjects n = 25 Mean ± SD</th>
<th>Significance p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood urea mg %</td>
<td>48.96 ± 14.62</td>
<td>26.62 ± 10.12</td>
<td>0.012</td>
</tr>
<tr>
<td>Serum creatinine mg%</td>
<td>1.17 ± 1.02</td>
<td>0.68 ± 0.22</td>
<td>0.017</td>
</tr>
</tbody>
</table>

Mean blood urea was 48.96 ± 14.62 in alcoholic subjects and 26.62 ± 10.12 in non alcoholic subjects and this difference was statistically significant p value 0.012. Mean serum creatinine was 1.17 ± 1.02 in alcoholic subjects and 0.68 ± 0.22 in non alcoholic subjects and this difference was statistically significant p value 0.017.

Discussion

Moderate alcohol consumption has been observed to have a favorable effect on several diseases in numerous studies during the past 20 years. Individuals who consume small to moderate amounts of alcohol are at decreased risk for CVD, including myocardial infarction (17) peripheral arterial disease,(18) angina pectoris,(19) and ischemic stroke, and have a decreased risk of dying. Beneficial effects of moderate alcohol consumption on renal function
are plausible; in recent years, traditional risk factors for CVD have been associated with an increased risk of developing renal dysfunction. (20) Furthermore, autopsy data suggested potential beneficial effects of alcohol consumption on the hyalinization in renal arterioles. In a prediction model for new-onset renal disease, several traditional CVD risk factors showed significant associations. (21,22).

**Folate and other vitamins**
Decreased plasma levels and increased urinary levels of folate due to chronic ethanol consumption may contribute to the development of folate deficiency. The folate binding protein, which is located in the brush border membrane (BBM) of proximal tubule cells, is thought to be involved in renal folate reabsorption. Ethanol probably affects in the renal uptake and metabolism of folate. Folic acid transport across the epithelial cell membrane of kidney tubules is an essential step for its reabsorption, conservation and homeostasis in the body. Chronic ethanol administration decreases the renal tubular reabsorption (23).

**Electrolytes**
Acute ethanol administration in rats alters renal sodium and potassium excretion. Chronic alcoholic patients may experience low blood concentrations of key electrolytes as well as potentially severe alterations in the body’s acid-base balance (24). In addition, alcohol can disrupt the hormonal control mechanisms that govern kidney function. By promoting liver disease, chronic drinking causes further detrimental effects on the kidneys including impaired sodium and fluid handling and even acute kidney failure.

**Ultrastructure**
Rats prenatally exposed to ethanol have renal ultrastructural abnormalities that may be important in the genesis of functional disturbances. More cases of appearances of basophilic renal tubular, swelling of tubular epithelial cells, urinary casts in tubular lumens, PAS (periodic acid-Schiff staining) positive deposits in glomerulus and atrophy of glomerulus were observed. Ethanol metabolites-protein adducts and hyaline in tubular epithelial cells in the kidney were observed after two-month ethanol administration. However, under long administration of six and eleven months, kidney showed atrophy of tubular epithelial cells, urinary casts, and cell infiltration to interstitial tissue. In addition thickening of basement membrane of glomerulus, PAS positive deposits in glomerulus, and proliferation of mesangial cell were observed in the kidney (25).

**Other effects**
Atherosclerosis development is accelerated in chronic renal failure (CRF) and is the major cause of death in chronic alcoholism. An increased oxidative stress and an endothelial dysfunction, with their complex interrelationships are relevant aspects of atherogenesis in CRF patients and might be targets for treatment (26). In our study Mean blood urea was 48.96 ± 14.62 in moderate to severe alcoholic subjects and 26.62 ± 10.12 in non alcoholic subjects and this difference was statistically significant p value 0.012. Mean serum creatinine was 1.17 ± 1.02 in alcoholic subjects and 0.68 ± 0.22 in non alcoholic subjects and this difference was statistically significant p value 0.017. This shows that moderate to severe alcohol consumption can decline Renal functions. Because of the kidneys’ important and varied role in the body, impairment of their function can result in a range of disorders, from mild variations in fluid balance to acute kidney failure and death.
Conclusion
Alcohol, one of the numerous factors that can compromise kidney function can interfere with kidney function through acute or chronic consumption. Excessive alcohol consumption can have profound negative effects on the kidneys and their function in maintaining the body’s fluid, electrolyte, and acid-base balance, leaving alcoholic people vulnerable to a host of kidney related health problems. Despite the clinical importance of alcohol’s effects on the kidney, however, relatively few recent studies have been conducted to characterize them or elucidate their pathophysiology. It is hoped that future investigations will focus on this important subject area.

References
4. Subir Kumar Das and D M Vasudevan. Alcohol induced effects on kidney. Indian Journal of Clinical Biochemistry, 2008 / 23 (1) 4-9
22. Alcohol Consumption and the Risk of Renal Dysfunction in Apparently Healthy Men, Elke S. Schaeffner, MD, MSc; Tobias Kurth, MD, ScD; Paul E. de Jong, MD, PhD; Robert J. Glynn, PhD, ScD; Julie E. Buring, ScD; J. Michael Gaziano, MD, MPH. Arch Intern Med. 2005; 165: 1048-1053