INTRODUCTION

The incidence and prevalence of obesity has greatly increased in the modern world. This has led to an increase in the obesity related problems. Obesity is common not only in the western nations but also in the Asian countries now.[1,2,3] Obesity increases the risk of metabolic syndrome, diabetes mellitus and coronary artery disease. Recent studies have showed that non-alcoholic fatty liver disease is also a manifestation of metabolic syndrome. Over the past 20 years, the number of patients with alcoholic related liver disease and infection with Hepatitis B and Hepatitis C has remained stable. But the patients with non-alcoholic fatty liver disease have increased.[4]

When there is more than 5% lipid accumulation in the hepatocytes after excluding other disease etiologies like virus, autoimmune, alcohol, drugs and genetics, it is defined as non-alcoholic fatty liver disease.[5] When this progresses to hepatic steatosis with hepatocytes inflammation, it is defined as non-alcoholic steato-hepatitis. This can eventually lead to liver cirrhosis and can even cause liver failure in extreme cases.

Metabolic syndrome has a strong co-relation with non-alcoholic fatty liver disease and this is also possible vice-versa. Non-alcoholic fatty liver disease can lead to dyslipidemia. Many studies have showed that 20-80% of patients with NAFLD have dyslipidemia.[6] This dyslipidemia is mainly consistent of high triglyceride and low HDL levels. NAFLD is also associated with increased abdominal girth and increase in levels of VLDL. All these leads to insulin resistance and this leads to development of metabolic syndrome.[7]

There is insulin resistance in both diabetes and NAFLD[8] but many studies suggest that NAFLD can lead to increase in the risk of development of pre-diabetes and type 2 diabetes mellitus.[9,10,11] Furthermore, there is dose dependent positive association between degree of hepatic...
steatosis and future risk of development of type 2 diabetes mellitus. Studies have showed that with NAFLD, there is a two fold increase in risk of development of type 2 diabetes mellitus and with hepatic fibrosis, the risk is 4 times. [9]

Many studies have also showed that NAFLD leads to systemic inflammation, endothelial dysfunction, hemodynamic alteration and all these vascular complications leads to atherosclerosis. [13,14] This leads to an increase in incidence of hypertension in NAFLD patients. Also, dysregulated flow-mediated vasodilatation, increased thickness of intima-media, and plaques in carotid arteries, which are well-established surrogate markers for subclinical atherosclerosis, are exhibited in patients with NAFLD. [15]

NAFLD is associated with a strong increase in incidence of hypertension, dyslipidemia and development of metabolic syndrome. These are all well established risk factors for coronary artery disease. Hence, NAFLD is associated with an increase in the incidence of coronary artery disease.

METHODS
In this study, we took a total of 102 patients. This was a retrospective study. All patients underwent coronary angiography. All 102 patients had significant coronary artery disease i.e. stenosis of >75%. Exclusion criteria were alcohol consumption, chronic liver disease, presence of HbsAg or HCV antibody, previous exposure to cytotoxic drugs or previous episode of jaundice. Detailed history and physical examination was done in all the patients. Height, Weight, ALT, AST and complete lipid profile were done of all the patients. USG-abdomen was conducted in all the patients to find any liver pathology. Statistical analysis of all the data was done.

RESULTS
The baseline characteristics of all the patients are showed in table 1. The mean age in the NAFLD group was 57.86 years and in non NAFLD group was 59.58 years. In NAFLD group, there were 28 males and 42 females. In non-NAFLD group, there were 12 males and 20 females. The mean height and weight in NAFLD group was 167.45 cm and 74.15 kg respectively. In non-NAFLD group, the mean height was 168.35 cm and mean weight was 78.16 kg. The waist circumference was 101 cm in NAFLD group and 92 cm in non-NAFLD group. Mean ALT and AST were 28 and 24 in NAFLD group and 28 and 20 in non-NAFLD group respectively. Total cholesterol was 171 mg/dl in NAFLD group and 164 mg/dl in non-NAFLD group. In NAFLD and non-NAFLD group, HDL cholesterol levels were 46 mg/dl and 49 mg/dl respectively. In NAFLD and non-NAFLD group, LDL cholesterol levels were 84 mg/dl and 82 mg/dl respectively.

Table 1: Baseline characteristic of the patients.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>NAFLD</th>
<th>No NAFLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>57.86</td>
<td>59.58</td>
</tr>
<tr>
<td>Male sex</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Female sex</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>Height</td>
<td>167.45</td>
<td>168.35</td>
</tr>
<tr>
<td>Weight</td>
<td>74.15</td>
<td>78.16</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>101</td>
<td>92</td>
</tr>
<tr>
<td>ALT</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>AST</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>171</td>
<td>164</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>46</td>
<td>49</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>84</td>
<td>82</td>
</tr>
</tbody>
</table>

Another characteristic is showed in the table 2. Out of 102 participants, 70(68.62%) turned out to have non-alcoholic fatty liver disease on USG-abdomen. Rest 32(31.72%) participants did not have non-alcoholic fatty liver disease on USG-abdomen. There was a great difference seen in these groups. P value is <0.01. Hence, the difference is statistically significant and not by chance. Thus, from this analysis, it can be said that non-alcoholic fatty liver disease does increase the risk of development of coronary artery disease.

Table 2: Non-alcoholic fatty liver disease in coronary artery disease.

<table>
<thead>
<tr>
<th>Total number of patients</th>
<th>Patients who had non-alcoholic fatty liver disease</th>
<th>Patients who did not have non-alcoholic fatty liver disease</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>70(68.62%)</td>
<td>32(31.72%)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

DISCUSSION
The term non-alcoholic fatty liver disease was coined by Ludwig and his colleagues. It describes a form of liver disease with histological evidence of alcoholic hepatitis in middle aged patients with abnormal liver enzymes but no history of alcoholic abuse. The major risk factors for development of non alcoholic fatty liver disease are obesity, starvation, kwashiorkor, inborn errors of metabolism in liver. Minor risk factors include inflammatory bowel disease, severe anemia, small bowel resection and other errors in metabolism. [16]

Coronary artery disease is a group of diseases that include stable angina, unstable angina and myocardial infarction. Risk factors for CAD include old age, positive family history, genetic factors, hypertension, smoking, dyslipidemia, diabetes, obesity, sedentary lifestyle and stress. [17,20]

Most of the patients of non-alcoholic fatty liver disease don’t have any symptoms. It’s only an incidental finding. Few patients’ complained of mild and vague right upper quadrant pain and malaise.
As mentioned earlier, non alcoholic fatty liver diseases can lead to dyslipidemia, hypertension, atherosclerosis, metabolic syndrome and diabetes mellitus. All these are risk factors for development of coronary artery disease. Hence, in patients with non-alcoholic fatty liver disease, there is a substantial increase in the incidence of coronary artery disease. Our study proves this point by showing that 68.62% of participants with coronary artery disease have non-alcoholic fatty liver disease.

Loannou et al conducted a cross sectional study of comparing 10 year risk of cardiovascular events based on the Framingham risk score in patients with fatty liver disease. This study showed that NAFLD is an independent risk factor for development of coronary artery disease.[21]

Apart from this, many longitudinal studies have showed that cardiovascular diseases are one of the most important cause of morbidity and mortality in patients with NAFLD.[22,23,24]

CONCLUSION
Non-alcoholic fatty liver disease leads to an increase in the incidence of coronary artery disease.

REFERENCES
8. Lee MK, Rhee EJ, Kim MC, Moon BS, Lee JI, Song YS, Han EN, Lee HS, Son Y, Park SE, Park CY, Oh KW, Park SW, Lee WY. Metabolic health is more important than obesity in the development of nonalcoholic fatty liver disease: a 4-year retrospective study. Endocrinol Metab (Seoul), 2015; 30: 522–530.

