INTRODUCTION
Chronic complications of Diabetes Mellitus affect many organ systems of which cardiovascular is the leading cause of morbidity and Ischemic Heart disease is the most common cause of mortality. Presence of DM increases the risk of Coronary artery disease. Among patients with coronary artery disease, diabetes mellitus is associated with risk of development of acute coronary syndrome and increased risk of death after AMI. There had been studies in which association between diabetes retinopathy & coronary artery disease was studied (1-9). There is conflicting evidence as in some studies no correlation was found but in other studies there was significant association between diabetic retinopathy and coronary artery disease. Hence diabetic retinopathy can be used as early marker for presence of coronary artery disease. Therefore this study was conducted to investigate correlation between diabetic retinopathy and coronary artery disease.

AIMS AND OBJECTIVES
1) To study correlation between occurrence of diabetic retinopathy & coronary artery disease.
2) To find out whether diabetic retinopathy can be used as a non-invasive early marker for coronary artery disease

MATERIAL AND METHODS
This study was conducted on patients with Type 2 Diabetes Mellitus during December 2010 to December 2011. The study sample consisted of 100 patients with Type 2 Diabetes Mellitus with retinopathy. Inclusion Criteria - Patients with type 2 DM were included in the study. Exclusion Criteria - Type 1 DM. After clinical history thorough clinical examination was done after mydriasis with instillation of tropicamide. The findings in worst eye were taken as findings of retinopathy. Fundus findings were confirmed by Ophthalmologist.

RESULTS
42 patients had cardiac changes which included PSVT, AF, first degree AV block, VPCs, LBBB and ejection fraction less than 45% in 18%. Severity of retinopathy was associated with duration of diabetes, poor glycemic control and increased Cholesterol. There was statistically significant association between cardiac changes and severity of retinopathy. Conclusion - Patient with retinopathy in Diabetes have high prevalence of cardiac risk factors and retinopathy can be used as predictor of coronary artery disease in patient with Diabetes Mellitus.
Graph 3:- Distribution of patients with respect to retinopathy and cholesterol.

[In graph normal means Serum cholesterol <200mg/dL while abnormal means Serum cholesterol ≥200mg/dL]

The proportion of patient with cholesterol >200mg/dL increases from 30% in mild NPDR to 46.66% in PDR, p-value < 0.05 therefore there was association between the retinopathy and cholesterol level in relation to severity.

Graph 4:- Distribution of patients with respect to types of retinopathy and HbA1c.

52 patients had HbA1c more than 8.5%. The proportion of patients with HbA1C more than 8.5% increases from 16.66% in mild NPDR to 76.66% in PDR, p-value < 0.05 therefore there is association between the retinopathy and HbA1c in relation to severity.

Graph 5:- Distribution of patients with respect to cardiac changes and retinopathy.

The percentage of patients having cardiac changes increased from 23.33% in mild NPDR to 70.0% in PDR, p-value < 0.05 therefore there is association between cardiac changes and severity of retinopathy

Table 1:- Distribution of ECG changes

<table>
<thead>
<tr>
<th></th>
<th>Arrhythmia</th>
<th>LAD</th>
<th>LVH</th>
<th>Abnormal</th>
<th>QRST</th>
<th>ST</th>
<th>Abnormal T waves</th>
<th>LBBB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild NPDR</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td></td>
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<tr>
<td>Moderate NPDR</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Severe NPDR</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PDR</td>
<td>2</td>
<td>12</td>
<td>12</td>
<td>6</td>
<td>7</td>
<td>12</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>22</td>
<td>20</td>
<td>12</td>
<td>22</td>
<td>29</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

This is observational table showing distribution of various ECG changes with respect to types of retinopathy.

Graph 6 :- Distribution of patients with respect to retinopathy and LVH.

LVH was present in 2 (6.66 %) of mild NPDR patients while LVH was present in 12 (40%) of PDR patients. Conclusion :- By using Fisher’s exact test p-value < 0.05 therefore there is association between the retinopathy and LVH.

Graph 7:- Distribution of patients with respect to retinopathy and LVDD.

Total 40 patients had LVDD. It was present in 20% of mild NPDR patient while 66.66% patients of PDR had left ventricular diastolic dysfunction.

Conclusion :- By using Fisher’s exact test p-value < 0.05 therefore there is association between the severity of retinopathy and LVDD.

Graph 8 :- Distribution of patients with respect to cardiac changes and HbA1c

In the present study 48 patients had HbA1c in between 6.5% to 8.5% out of this 14 had cardiac changes (29.16%) while 52 patients had HbA1c more than or equal to 8.5 out of which 28 had cardiac changes (53.84%), p-value < 0.05 therefore there was association between cardiac changes and HbA1c.

Graph 9:- Distribution of patients with respect to cholesterol and cardiac changes.

Serum cholesterol was more than 200 mg% in 37 patients out of which 24 had cardiac changes (64%) while 63 patient had cholesterol less than 200 mg% out of which 18 had cardiac changes (28.57%), p-value < 0.05 therefore there is association between cardiac changes and cholesterol.
In this study there was statistically significant association between cardiac changes and hypertension in relation to severity (p=0.006). LVH (p=0.002) showed significant association while rhythm abnormality (p=0.018), ST changes (p=0.532) and albuminuria (p=0.145), and wave abnormalities (p=0.263), LBBB (p=0.777) had no association with severity of retinopathy.

In this study there was association between cardiac changes and hypertension were statistically significant (p=0.012). The association of hypokinesia, decreased ejection fraction with retinopathy in relation to severity was not statistically significant (p=0.021) while the association between diabetic retinopathy and LVDD in relation to severity was statistically significant (p=0.001).

Association of cardiac changes with other risk factors
In this study there was association between cardiac changes and duration of diabetes (p=0.002), poor glycemic control (p<0.001), increased cholesterol (p<0.001), severity of retinopathy and presence of albuminuria. The association between smoking and retinopathy in relation to cardiac changes was not statistically significant (p=0.33). The association between risk factors and cardiac changes were studied in various studies [1-9] Thus the cardiac outcome in diabetics is multifactorial and depends upon multiple factors. Hence multivariate logistic regression analysis was applied to assess the association between various dependent factors and cardiac outcome.

In multivariate logistic regression analysis cholesterol, duration of diabetes and hypertension were statistically significantly associated with cardiac changes.

Cardiac changes
The cardiac changes included were ECG changes - arrhythmias, left axis deviation, left ventricular hypertrophy, QRS abnormality (Q5 pattern, pathological Q wave i.e. Q/R ≥1, widened QRS complex i.e. duration more than 120msec) ST changes (ST depression, ST elevation ≥1 mm in limb lead ≥2 mm in chest lead) JT wave abnormalities (T inversion, T flattening). In this study ECG changes were seen in 42 patients. The most common ECG abnormality was T wave inversion which was seen in 29 patients followed by ST changes (22%), LAD (22%), LVH (20%), QRS abnormality in 12% patients. Out of these 42 patients, 10 patients had Acute myocardial infarction, 3 had inferior wall AMI, 6 had anterior wall AMI, 1 had posterior wall AMI. Of these 10 patients 4 had chest pain, 2 had angina equivalent and presented in shock 4 had silent AMI at time of presentation. LVH was present in 20 patients. LAD was present in 22 patients. LBBB was present in 3 patients out of which 2 were asymptomatic one was having chest pain but no fresh ECG changes. HHD was present in 25 patients. Rhythm abnormalities were present in 4 patients out of which 1 had PSVT, 1 had AF, 1 had VPCs in presence of Inferior wall AMI, 1 had inferior wall AMI with first degree AV block. Sinus tachycardia was present in four patients with AMI.

In the present study there was statistically significant association between cardiac changes and retinopathy in relation to severity (p=0.008) out of which LAD (p=0.045), LVH (p=0.002) showed significant association while rhythm abnormality (p=0.018), ST changes (p=0.532), QRS abnormality (p=0.145), T wave abnormalities (p=0.263), LBBB (p=0.777) had no association with severity of retinopathy.

Association of cardiac changes with other risk factors
In our study there was association between cardiac changes and duration of diabetes (p=0.002), poor glycemic control (p<0.001), increased cholesterol (p<0.001), severity of retinopathy and presence of albuminuria. The association between smoking and retinopathy in relation to cardiac changes was not statistically significant (p=0.33). The association between risk factors and cardiac changes were studied in various studies [1-9]. Thus the cardiac outcome in diabetics is multifactorial and depends upon multiple factors. Hence multivariate logistic regression analysis was applied to assess the association between various dependent factors and cardiac outcome.

In multivariate regression analysis the association between retinopathy (p=0.573), albuminuria (p=0.134), poor glycemic control (p=0.181) with cardiac changes became statistically non-significant. Significant risk factors for cardiac changes in patients of diabetic retinopathy were dyslipidemia, duration of diabetes and presence of hypertension.

Diabetic retinopathy was independent risk factor for CVD while in some others study there was no association between retinopathy and CVD.

CONCLUSION
1. Thus the presence of retinopathy is significantly associated with cardiac changes in patients of DM.
2. Patient with retinopathy have high prevalence of other risk factors like hypertension, dyslipidemia, poor glycemic control.
3. Thus in patients with retinopathy other cardiovascular risk factors should be aggressively searched for and should be treated aggressively.
4. Though the cardiac changes can be attributed to other cardiovascular risk factors like hypertension, dyslipidemia, poor glycemic control, retinopathy can be used as predictor of coronary artery disease in patient with diabetes mellitus.