INTRODUCTION
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Diabetes mellitus is a clinical syndrome characterised by hyperglycemia due to deficiency or ineffectiveness of insulin, which effects the metabolism of carbohydrate, protein, fat, water and electrolytes. It may lead to permanent and irreversible changes both structural and functional in cardiovascular, kidney, eye and nervous systems.

The involvement of heart and vessels continues to be the outstanding factor in over all morbidity and mortality.

Lewine (1932) gave the first suggestion that diabetics are excessively prone to heart disease. The heart in patients with diabetes mellitus may be involved in several different ways -

1. Large vessel disorder affecting the coronary vessels causing manifest cardiac disease.
2. A subclinical involvement producing abnormality of left ventricular function.
3. As a result of autonomic neuropathy presenting in form of impaired vasomotor reflex response.
4. Hypertension and hypertensive cardiac disease.
5. Associated valvular disease.

The vascular disease associated with diabetes mellitus can be non specific (Atherosclerosis and arteriosclerosis) or specific (microangiopathy). The
Atherosclerosis is more severe and extensive in diabetics as compared to non diabetics resulting in an increased frequency of myocardial infarction, cerebral and peripheral vascular disease (Walter et al., 1980). Diabetes should be considered to be a separate risk factor for coronary heart disease (Stone et al., Woods et al., 1989).

Several factors contribute to the increased morbidity of diabetic patients with acute myocardial infarction. The size of infarct is bigger in diabetics as compared to non diabetics. Diabetic patients have a greater frequency of both congestive heart failure and shock than do the non diabetics (Stone et al., 1989; Abbott et al., 1988; and Savage et al., 1988).

In the Framingham prospective community study clear excess was noted in the mortality among diabetics than non diabetic from sudden death, cardiac infarction and cardiovascular disease (Garcia et al., 1973). In diabetics the coronary vascular disease frequently appears at an early age, is more severe, rapidly progressive and more often fatal.

Diabetes mellitus has been linked with cardiomyopathy. The most common histological abnormalities are interstitial fibrosis and arteriolar hyalinization but there is no evidence of large vessel disease or abnormalities in myocardial capillary basal lamin a documented by endomyocardial biopsy (Sutherland et al., 1989).
Both systolic and diastolic dysfunctions have been observed. Severity of this dysfunction is related to the degree of metabolic control and according to Hausdorf et al (1988) there is no clinical evidence of cardiovascular or microvascular disease.

Factors which have been reported to contribute to the abnormalities in left ventricular function in diabetics are:

1. The role of hypertension with concomitant increase in left ventricular mass (Daneilson et al, 1988).
2. Increased cardiac sorbitol level (Nakada et al, 1989).
3. The impairment of Ca^{++} handling with hypersensitivity of myocardium to the calcium secondary to increased sarcolemal Ca^{++} ATPase activity (Borda et al, 1988; Schaffer et al, 1989).

The process of atherosclerosis tends to be more severe in diabetic patients than in non diabetics resulting in an increased frequency of myocardial infarction. Indeed coronary artery disease is the leading cause of death among adult diabetics and accounts for three times as many deaths among diabetics than non diabetics.

The occurrence of coronary artery disease correlates more closely with the duration of diabetes than its severity.

Laboratory testing in asymptomatic diabetes show a surprisingly high prevalence of cardiac abnormalities. Zoneraich reported ECG abnormalities in 51% and
vector cardiographic abnormalities in 75% of a group of ambulatory patients who were asymptomatic diabetics between the age of 15-81 years. Evidence of myocardial infarction was present in 14% whereas 41% had distorsions of QRS vector loop, 25% of the diabetics show intraatrial conduction disturbances (Zoneraich and Zoneraich).

The pattern of CAD as reported in India is as under:

- IHD appears a decade earlier in life as compared to the age incidence in developed countries.
- Males suffer more than the females, ratio being 4:1.
- Diabetes mellitus and hypertension account for about 40% of all cases.
- Heavy smoking is an important risk factor in a fair number of cases.

Most common causes of ischemia is atherosclerotic disease of epicardial coronary arteries leading to luminal narrowing in these vessels to the extent that there is absolute decrease in myocardial perfusion in basal states or there is lack of appropriate increase in perfusion when the demand is increased due to increased work load.

If there is a specific diabetic disorder of the myocardium, there should be a strong correlation between the degree of clinical microvascular disease and left ventricular function. The frequency and severity of abnormality should increase with duration of diabetes and as shown with retinopathy and proteinuria.
Myocardial function can be assessed by non-invasive diagnostic techniques reliably using TMT, and echocardiograph. Chest pain on exertion is the first symptoms that forces a patient to seek advice of his physician. Earliest contribution in the field of exercise ECG was from Bousfield who recorded ST segment depression in three standard leads for the first time during spontaneous angina in 1918.

Later Fcoil and Seigal (1928) demonstrated that angina was accompanied by a prolonged period of ST segment depression. They used the term positive response when ST-T wave changes were produced by exercise along with the increase of anginal pain. ECG abnormalities in angina patients were due to reduction of blood flow to the heart and ECG findings return to normal when chest pain subsides and also when nitroglycerides was given to the patient with angina pectoris. They performed their exercise test by having the patient to do sit-ups. Einthoven also recorded the ST segment depression after exercise.

Master (1929) published his first paper regarding the exercise ECG test. He measured only pulse and blood pressure to evaluate the cardiac capacity and he failed to recognize the value to electrocardiographic finding to diagnose ischaemia. After 12 years of Master's original contribution the importance of taking electrocardiogram before and after exercise to detect the
coronary insufficiency was first proposed by Master himself along with Jaffe.

The Master's test has a sensitivity of 48-60% and specificity of 80-83% in detection of coronary atherosclerosis, but an important limitation of Master's test is that in some patients, the single workload used requires an increase in MVO2 which is inadequate to elicit ischemic manifestation.

Until 1955, the Master's test was the exercise ECG test of choice. Since 1956, modern exercise ECG test using a motor driven treadmill or bicycle ergometer have been used for research purposes as well as for clinical practice.

Both bicycle ergometer and treadmill are very popular at present but treadmill has some advantages over the bicycle ergometer because maximal oxygen uptake is 6-28% higher in the former as compared to later.

In addition to these, other forms of stress tests have also been developed such as induced hypoxia, isometric exercise and atrial pacing. These stress tests have not gained popularity owing to difficulties in performance and standardization as well as lack of sensitivity and specificity.

Several abnormalities of ventricular function using echocardiographic technique have been reported.

1. Echocardiography can detect ischemic myocardium allowing appreciation of motion, thickening of wall and thickening of various segments of heart.
2. Mitral valve end point septal sepration and abnormal closer of mitral valve gives reasonable assessment of altered left ventricular function in patients with CAD.

3. There is loss of myocardial thickening localised dilatation and frequently dyskinesia, the anterior septum became thin and scarred. The apex shows a characteristic distortion in shape and function.

Cardiomyopathy may be a manifestation of diabetes mellitus - echocardiographic finding is dilated and poorly contracting left ventricle.