CLINICAL PROFILE OF PATTERN OF DYSLIPIDAEMIA AND ISCHAEMIC HEART DISEASE IN TYPE II DIABETES MELLITUS PATIENTS

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ABSTRACT

BACKGROUND

The present research was undertaken to study the pattern of dyslipidaemia and varied clinical manifestations of ischaemic heart disease, its risk factors in type 2 diabetes mellitus patients.

Diabetes Mellitus (DM) has become major public health problem in India. It is not only increasing in morbidity and mortality, but also decreases the quality of life. Also, disease and its complications are causing heavy economic burden for patients suffering from it.[1,2] Diabetes is endemic globally with increasing prevalence in both developing and developed countries. Diabetes is a major cause of mortality, but several studies indicate that it is likely underreported as a cause of death. A recent estimate suggested that diabetes was the fifth leading cause of death worldwide and was responsible for almost 3 million deaths annually (1.7-5.2% of all deaths).

MATERIALS AND METHODS

A total of 100 patients attending the outpatient department or admitted to medical wards, ICU of tertiary care centre and fulfilling the inclusion criteria were evaluated clinically. A baseline Electrocardiogram (ECG) was taken in all cases irrespective of clinical evidence of cardiac involvement. Patients with normal ECG pattern were further evaluated by Treadmill Testing (TMT or stress test) for subclinical cardiac involvement. Risk factor evaluation was done in all cases.

RESULTS

Prevalence of IHD was found to be 41% with a male predominance (1.067:1). Evaluation of risk factors has shown its strong association with IHD. Incidence of IHD was high when low HDL (P <0.001), increased TC, TG, LDL (P<0.001), which were statistically significant. However, BMI >25 had negatively significant association with IHD in type 2 diabetics (P=0.072). Smoking was not statistically associated (P=0.577) and in male alcoholics, IHD had positive association with alcohol (P=0.193).

CONCLUSION

The current study points out that there exists an increased incidence of ischaemic heart disease in diabetics with few, but not all risk factors contributing to it. Early detection, optimal glycaemic control, reduction of risk factors and patients education can reduce the mortality and morbidity.

KEYWORDS

Type 2 Diabetes Mellitus, Ischaemic Heart Disease, Fasting Blood Sugar, Postprandial Blood Sugar, Electrocardiogram.

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BACKGROUND

Diabetes Mellitus (DM) has become major public health problem in India. It is not only increasing morbidity and mortality, but also decreases the quality of life. Also, disease and its complications are causing heavy economic burden for patients suffering from it.[1,2] Diabetes is endemic globally with increasing prevalence in both developing and developed countries. Diabetes is a major cause of mortality, but several studies indicate that it is likely underreported as a cause of death. A recent estimate suggested that diabetes was the fifth leading cause of death worldwide and was responsible for almost 3 million deaths annually (1.7-5.2% of all deaths).[3]

Currently, India has got the largest number of diabetics in the world[3] and has the dubious distinction of being called the 'diabetes capital of the world.'[4] Asian Indians have a racial predisposition and other unique risk factors to develop DM to a greater extent. In India, there is increasing urbanisation and industrialisation, which has led to physical inactivity, sedentary lifestyle, psychosocial stress and obesity leading to progressive increase in prevalence of DM.[4]

Concomitant with the increasing prevalence of DM, the prevalence of micro and macrovascular complications such as coronary artery diseases, cerebrovascular accidents, peripheral vascular diseases, retinopathy, neuropathy,

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nephropathy and other complications will also increase.[5]Out of these complications, Ischaemic Heart Disease (IHD) is a leading cause of mortality. Although, it is a well-known fact that ischaemic heart disease is a leading cause of death independently worldwide, its presence in patients with DM is a dreaded combination. The fact that diabetics have an increased incidence of heart disease and vice versa indicates that the link between the two is more than a coincidence. DM is a major cause of silent myocardial ischaemia, which usually goes undetected. It is now well established that a number of traditional coronary artery disease risk factors (e.g. hypertension, dyslipidaemia, insulin resistance) tend to occur in patients with DM.[6] Approximately, 50% of patients with DM have hypertension and more than 30% have hypercholesterolaemia at the time of diagnosis.

People with DM have a risk of IHD 2-5 times that of nondiabetic individuals, hence early recognition of IHD in DM patients is important in the management and prognostic purposes. Because of its frequency and its role as the cause of death in the majority of diabetic patients, the salient features of IHD in type 2 DM patients are the subject of this study.

Aims and Objectives

The present research was undertaken to study the pattern of dyslipidaemia and varied clinical manifestations of ischaemic heart disease, its risk factors in type 2 diabetes mellitus patients.

MATERIALS AND METHODS

A total of 100 patients (age above 30 years) attending the medical outpatient department, diabetic clinic or admitted into medical wards, ICU of tertiary care centre were recruited over a period of 18 months. The study included patients diagnosed to have type 2 diabetes mellitus irrespective of symptoms suggestive of ischaemic heart disease (as diagnosed by WHO criteria).[3] This study was approved with ethical clearance obtained from the local authority. All patients signed informed concern. A clinical assessment was made for selection of patients with type 2 DM and those often exhibits the features like- develop diabetes after the age of 30 yrs. are usually obese (80% are obese, but elderly individuals may be lean), may not require insulin therapy initially, may have associated conditions such as insulin resistance, hypertension, cardiovascular disease, dyslipidaemia or polycystic ovarian syndrome.[3] Patients with type 1 diabetes mellitus, women with gestational diabetes mellitus, patients with pulmonary embolism, cor pulmonale, rheumatic heart disease and congenital heart disease, patients with acute pericarditis and acute myocarditis were excluded from the study.

A baseline Electrocardiogram (ECG) was taken in all cases irrespective of clinical evidence of cardiac involvement. Patients with normal ECG pattern were further evaluated by Treadmill Testing (TMT or stress test) for subclinical cardiac involvement. A detail general and systemic examination was done for all the patients.

The criteria for selection of patients given as follows-

1. **Diabetes Mellitus**- The selection of patients was made as per WHO criteria.
2. **Ischaemic Heart Disease Angina**- The patients with symptoms of angina with or without ECG changes. Asymptomatic patients with typical ECG changes for silent ischaemia were also included.

Acute Myocardial Infarction- (i) The patients with typical symptoms and signs of acute myocardial infarction with ECG changes. (ii) Asymptomatic patients with ECG changes suggestive of acute MI (silent MI). (iii) In patients with typical symptoms of acute MI, but whose ECG is unequivocal, the diagnosis of acute MI was made based on the levels of cardiac enzymes.

Latent Coronary Artery Disease (Stress Test)- Modified Bruce protocol was used for stress test as it can be used in old age patients and patients with decreased exercise capacity. Test was considered positive if following criterias were satisfied.

1. Horizontal or down slopping ST depression of 1 mm or greater at 80 ms from J point (1.5 mm if it is up sloping).
2. ST segment elevation of 1 mm or more than the control tracing in any lead except aVR.
3. In the presence of ST depression in the control tracing, additional depression of 1 mm more than the rest.
4. ST segment depression for greater than 5 mins. during recovery period.
5. Abnormal blood pressure response.
6. Ventricular arrhythmias.

Stress Test was Terminated if-

1. Anginal pain is progressive.
2. Drop in systolic blood pressure below the resting value or non-raising systolic BP with continued exercise.
3. Frequent VPC's developing in pairs or with increasing frequency as exercise increases or when ventricular tachycardia or ventricular fibrillation develops.
4. Onset of second or third-degree heart block.
5. Marked ST segment depression (>3 mm).
6. ST segment elevation of 2 mm or more.
7. Patients are unable to continue because of dyspnoea, fatigue or dizziness.
8. Development of bundle-branch block that cannot be distinguished from ventricular tachycardia.

Congestive Cardiac Failure

1. The patients were selected with typical signs and symptoms like exertional breathlessness, easy fatigability and clinical signs of cardiomegaly, pulmonary oedema and tender hepatomegaly and raised JVP.
2. Patients with radiographic and/or electrocardiographic/echo evidence of cardiomegaly.

Arrhythmias- was based on ECG criteria.

Dilated Cardiomyopathy- The evaluation of dilated cardiomyopathy was done after excluding ischaemic, valvular and hypertensive heart disease.

Hypertension- The detection of hypertension in patients was made as per the Seventh US Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure (JNC 7) criteria as shown in Table 1. The patients were categorised as hypersensitive if he is in stage I or stage II.

Stages of Hypertension	Systolic (mmHg)	Diastolic (mmHg)
Normal	<120	<80
Prehypertension	120-139	80-89
Stage I	140-159	90-99
Stage II	>160	>100

Table 1. Showing Stages of Hypertension

Statistical Methods[7-10]

Descriptive statistical analysis has been carried out in the present study. Results on continuous and categorical measurements were presented on Mean ± SD (min-max) and in number (%), respectively. Significance was assessed at 5% level of significance. Student's t-test (two tailed, independent) has been used to find the significance of study parameters (on continuous scale between two groups intergroup analysis) on metric parameters, Chi-square/Fisher exact test used to find the significance of study parameters on categorical scale between two or more groups. Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver. 2.11.1 were used for the analysis of the data.

OBSERVATIONS AND RESULTS

There were a total of 100 subjects, 60% were males and 40% were females. The mean age of patients was 56.11 years; maximum number of patients (73%) in the study group was in the age group of 41-60 years. The mean duration of diabetes mellitus was 8.66 years, males being 8.95 years and in females being 8.23 years. Table 2 show the mean age and BMI for male and female.

Parameters	Male	Female	Total	P value
Age in years	56.47 ± 11.66	55.68 ± 9.75	56.11 ± 10.89	0.691
BMI (kg/m^2)	23.27 ± 3.53	22.52 ± 2.61	22.97 ± 3.20	0.254

Table 2. Comparison of Age and BMI in Male and Female

The mean fasting blood sugar and postprandial blood sugar in the study group was 190.36 mg% and 262.78 mg%, respectively (Table 3).

Sugar Parameters	Male	Female	Total	P value
Random blood sugar	266.80 ± 64.17	272.33 ± 61.27	269.26 ± 61.74	0.822
Fasting blood sugar	183.53 ± 60.47	200.25 ± 60.03	190.36 ± 9.49	0.181
Postprandial blood sugar	255.98 ± 66.63	273.09 ± 59.95	262.78 ± 64.24	0.237

Table 3. Comparison of Random Blood Sugar, Fasting Blood Sugar and Postprandial Blood Sugar between Male and Female

Forty one out of 100 patients had ischaemic heart disease with a male-to-female ratio of 1.067:1. Out of 16 patients of angina pectoris, only 3 had symptoms correlating with angina and had resting ECG abnormalities. Rest 13 patients (31.7%) had latent coronary artery disease detected by stress test. Out of 25 patients with myocardial infarction, 9 patients (36%) had atypical or silent myocardial infraction, which was detected by routine ECG recording. 9 patients out of 25 patients of myocardial infraction died within one week of admission, immediate mortality being 36%. Four out of 100 patients (4%) had evidence of dilated diabetic cardiomyopathy. The predominant microvascular complications observed in the present study was retinopathy 46%, nephropathy 11% and neuropathy 14%. Hypertension was observed seen in 43% of the patients and the incidence of IHD was higher among this group (68.3%), statistically significant. 14 males and 3 females were chronic smokers. Incidence of IHD among the smokers was 47.1%, not statistically significant. 17 males were chronic alcoholics and 1 of the females consumed alcohol. The incidence of IHD among this group (only males) was 41.2%. Incidence of IHD in patients with BMI >25 was 23.8%, negatively significant association (p=0.072).

The mean total cholesterol, LDL cholesterol HDL cholesterol, triglyceride level and non-HDL cholesterol in the present study was 208.08 mg%, 117.88 mg%, 40.67 mg% and 163.65 mg%, 168.06, respectively, (Table 4). Mean total cholesterol, LDL cholesterol and triglycerides were higher in patients with CAD and HDL cholesterol was lower in patients with CAD when compared with patients without CAD, which was statistically significant. Therefore, the above mentioned factors were risk factors for CAD in patients with type 2 diabetes mellitus.

Lipid Parameters	Male	Female	Total	P value
Total cholesterol	205.47 ± 28.35	214.08 ± 45.51	208.08 ± 36.23	0.251
HDL	41.05 ± 3.05	40.11 ± 3.80	40.67 ± 3.39	0.173
LDL	116.43 ± 12.37	120.05 ± 12.11	117.88 ± 12.33	0.152
Triglycerides	161.13 ± 50.25	167.43 ± 48.53	163.65 ± 49.42	0.536
Non-HDL	162.24 ± 29.14	173.89 ± 46.48	168.065 ± 37.81	0.2049

Table 4. Comparison of Lipid Parameters between Male and Female

DISCUSSION

The current pandemic of type 2 diabetes mellitus has emerged as a global problem. India is the diabetes capital of the world. There is a higher incidence of ischaemic heart disease in diabetics when compared to the general population. Dyslipidaemia is one of the important metabolic abnormalities related with diabetes mellitus. Prevalence of DM is also increasing in rural areas. Hence, better knowing of the disease is important for prognostic and management purposes. This study focuses on the varied clinical manifestations of ischaemic heart disease in diabetics with evaluation of its risk factors.

Hundred patients of diabetes mellitus were studied in our series, among which 60 were males and 40 were females (ratio of male:female was 1.5:1). The mean age of patients was 56.11 ± 10.89 years (males 56.47 ± 11.66 years and female 55.68 ± 9.75 years), this was compared with the study of Walia et al.[11] The mean duration of diabetes mellitus was 8.66 years, (8.95 years in males and 8.23 years in females). In the present study, it was observed that type 2 diabetic patients had poor glycaemic control, which was reflected by higher values of fasting and post prandial blood sugar, this was compared with study done by Walia et al.[11]

Out of one hundred patients of diabetes mellitus, 41 patients had ischaemic heart disease out of which 16 patients had angina pectoris. Walia et al[11] reported prevalence of coronary artery disease among type 2 diabetes patients to be 15.57%. The present study correlates with the above-mentioned studies. Only 3 patients had typical history of chest pain correlating with angina pectoris and resting ECG was showing ischaemic changes. Rest of 13 patients (31.7%) had latent coronary artery disease, which was detected by treadmill test. Gupta et al[12] have reported in their study a prevalence of 36.3% of latent coronary artery disease. Among 25 patients of myocardial infarction, 10 patients were males and 15 patients were females. Females outnumbered the males in this study, which correlates with the study of Partamian et al.[13] 13 out of 25 patients had evidence of anterior/anterolateral infraction (52%). 5 patients (20%) had evidence of inferior wall myocardial infarction. 2 patients had evidence of inferior wall myocardial infarction with right ventricular extension. 5 patients had subendocardial infarction (20%). Out of the 25 patients with myocardial infarction, 9 patients (36%) presented with atypical manifestations/silent infarction, which was detected by serial electrocardiographic recording. Our study correlates with study of Morgolis et al.[14] Other authors have estimated the occurrence of unrecognised myocardial infarction between 0-60%. The immediate mortality (within 1 week) in the present study among the 25 patients with myocardial infarction was 36%. 9 patients died within 1 week of admission; out of them, 5 died within 24 hours of admission. Partamian et al[13] have reported immediate mortality among their patients to be 38% correlating with the present study.

Four out of one hundred patients (2 males and 2 females) had evidence of dilated cardiomyopathy. Echocardiography done on these patients revealed left ventricular dysfunction, dilated chambers and decreased ejection fraction. ECG showed nonspecific ST-T changes in one patient. All four presented with features of congestive cardiac failure. There were no causes of sudden cardiac death in our series. In this study, 10 patients presented with signs and symptoms of congestive cardiac failure. Women outnumbered the men with a ratio of 1.5 to 1. Agarwal et al[15] had reported the incidence of other microvascular complications of diabetes as retinopathy (67.9%), nephropathy (35.9%) and neuropathy (50.9%). In current study, the incidence was retinopathy (46%), nephropathy (11%) and neuropathy (14%).

The incidence of hypertension was 43%, this was similar to that reported by Banerjee (43.4%) and Liebow (47.8%). Raheja found that 64.3% of diabetes with hypertension had IHD.[16] In present study, the incidence was 68.3%.

Incidence of Hypertension	**CAD**	
	Absent	**Present**
Present	15 (25.4%)	28 (68.3%)
Absent	44 (74.5%)	13 (31.7%)
Total	**59 (100%)**	**41 (100%)**
Inference	Incidence of hypertension was significantly associated with CAD with p<0.001**	

Table 5. Association of Incidence of Hypertension with CAD

The mean body mass index in males was 23.27 (±3.53) and females was 22.52 (±2.61). Males were more obese than females. Fifteen males and six females had BMI above 25. Among the 21 patients with BMI >25, 5 patients had ischaemic heart disease (23.8%).

Incidence of CAD	**BMI (KG/M2)**	
	<25	**>25**
Present	36 (45.6%)	5 (23.8%)
Absent	43 (54.4%)	16 (76.2%)
Total	**79 (100%)**	**21 (100%)**
Inference	Incidence of CAD is negatively significant associated with BMI >25 KG/M2 with P=0.072+	

Table 6. Incidence of Association of CAD with BMI

It is evident from recent studies that none of the obesity indices (BMI, WHR and WC) other than percent body fat is significantly correlated with CAD in diabetic patients. Individuals with CAD and type 2 diabetes mellitus have exaggerated central (visceral) fat distribution. Visceral fat would not be properly reflected by either BMI or WHR.[17] Hence, our study correlates with these recent studies. Fourteen males and three females among the study group were chronic smokers (bidis/cigarettes). 17 males consumed alcohol almost regularly, 1 of the female patients was alcoholic.

Incidence of CAD	Smoking		Alcoholics (Males)	
	Absent	Present	Absent	Present
Present	33 (39.8%)	8 (47.1%)	9 (20.9%)	7 (41.2%)
Absent	50 (60.2%)	9 (52.9%)	34 (79.1%)	10 (58.8%)
Total	**83 (100%)**	**17 (100%)**	**43 (100%)**	**17 (100%)**
Inference	Incidence of CAD was not statistically associated with smoking with P=0.577		Incidence of CAD was positively associated with alcohol with p=0.193	

Table 7. Association of Incidence of CAD with Smoking Status and Alcoholic (Males)

The mean total cholesterol, LDL cholesterol and triglyceride and HDL-cholesterol, non-HDL cholesterol levels were 208.08 mg%, 117.88 mg%, 163.65 mg%, 40.67 mg%, and 168.06, respectively. The mean HDL-cholesterol in females was less than in males. The mean total cholesterol and triglyceride levels were higher in females when compared to males. Our study correlates with the Walia et al[11] study.

Lipid Parameters	CAD		P value
	Absent	Present	
Total cholesterol (mg/dL)	195.44 ± 32.26	228.22 ± 33.06	<0.001**
LDL (mg/dL)	115.03 ± 11.28	121.98 ± 12.77	0.005**
HDL (mg/dL)	41.85 ± 3.29	38.98 ± 2.76	<0.001**
Triglycerides (mg/dL)	145.24 ± 37.51	190.15 ± 52.78	<0.001**
Non-HDL	153.36 ± 32.49	189.51 ± 33.13	<0.0001

Table 8. Mean Lipid Parameters Patients With CAD and Without CAD

CONCLUSION

In the present study, it can be concluded that there is a high incidence of coronary artery disease with coronary risk factors in patients with diabetes mellitus. Early detection and treatment of hypertension can reduce the risk of cardiac complications. Diabetic dyslipidaemia is commonly present in many cases. Hypercholesterolaemia, high LDL cholesterol, hypertriglyceridaemia and low HDL cholesterol are all significant predictors of coronary artery disease in diabetes mellitus. Even modifiable risk factors like smoking and alcohol is present in a significant proportion of patients. All patients with type 2 diabetes mellitus should be screened for latent coronary artery disease as it has a prognostic implication.

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