

STUDY OF TYPE II DIABETES MELLITUS PATIENTS OF ASYMPTOMATIC HEART DISEASE BY NON-INVASIVE METHOD IN TRIPURA- A HOSPITAL-BASED STUDY

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ABSTRACT

BACKGROUND

Macro-vascular complications of diabetes mellitus remain the major cause of morbidity and mortality in diabetes today.

The objectives of this study were-

1. Assessment of magnitude of asymptomatic heart disease among diabetic patients
2. Evaluation of role of treadmill test or echocardiography or both over resting ECG in diagnosis of asymptomatic heart disease in those patients.

MATERIALS AND METHODS

The study was carried out among 253 type 2 diabetes patients. A pre-tested, pre-designed, structured interview schedule was used for data collection. Systematic random sampling technique was used to select the individual study subject. All the patients were subjected to 12 lead ECG in rest, Tread Mill Test & Echocardiography to find out any specific and or nonspecific ischaemic changes.

RESULTS

There were 60.9% male & 39.1% female patients with sex ratio of 1.5:1 and age ranges from 35 to 80 years. There was positive correlation with age of majority of patients with significant effect with asymptomatic heart disease (AHD).

CONCLUSION

For detection of AHD, TMT and ECHO combined were more effective. Diastolic dysfunction screening test for early detection of AHD in diabetes is very important. There may be some benefit of screening by non-invasive method to diagnose AHD early in diabetes so as to prevent morbidity and mortality as CAD remains single most common cause of death in this population. But most of the patients failed to recognize the classic symptoms of myocardial ischemia.

KEY WORDS

Type 2 Diabetes Mellitus, Asymptomatic Heart Disease, Diastolic Dysfunction

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BACKGROUND

Diabetes mellitus is known to the mankind from time immemorial and the earliest record of diabetes was made 3000 years ago and had been described by physicians of ancient civilizations of the world like Greece, Egypt, India and China (Cahill Jr, 1982). Shaprio LM¹ in 1982 described that in diabetes abnormalities cardiac functions are predominantly in diastole, with delayed opening of mitral valve and prolongation of iso-volumic relaxation time. Reduced ejection and abnormal systolic time interval are probably late events. These diastolic abnormalities may be differentiated from those found in occlusive coronary artery disease, where inordinate ventricular relaxation is the principal feature. Few studies² have been published looking at the utility of exercise testing in diabetics suspected having coronary artery diseases.

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The objectives of this study were-

1. Assessment of magnitude of asymptomatic heart disease among diabetic patients
2. Evaluation of role of treadmill test or echocardiography or both over resting ECG in diagnosis of asymptomatic heart disease in those patients.

MATERIALS AND METHODS

The study was carried out in Diabetes and nutrition clinic of Agartala Government Medical College and Govinda Ballabh Pant Hospital, Agartala during 4th December 2007 to 31st March 2010. Sample size of 246 ~ 250 was calculated using the formula $Z_{1-\alpha/2} \sqrt{p(1-p)/d^2}$, assuming prevalence of asymptomatic heart disease in diabetes about 20%, absolute error taken as 5%. The patients having type 2 diabetes mellitus for more than 10 years and age ≥ 35 years were included in the study. Patients with past history of myocardial infarction, evidence of acute myocardial infarction, suggestive history of ischaemic heart disease, signs of congestive heart failure, history of acute febrile illness, and or acute infection, history of renal and or hepatic impairment, evidence of chronic obstructive pulmonary disease, pregnancy, hypertension and pericardial disease were excluded from the study. A pre-tested pre-designed structured interview schedule was used for data collection.

Systematic random sampling technique was used to select the individual study subject. All the patients were subjected to a battery of required investigations. All the patients were

subjected to 12 lead ECG in rest, Tread Mill test (Bruce protocol) & Echocardiography to find out any specific and or nonspecific ischaemic changes.

<p>Resting ECG:</p> <ul style="list-style-type: none"> • Specific changes ST ↓, ST↑, Q, T Inversion • Non-Specific changes <p>Echo Cardiography: Wall motion at rest EF at rest</p> <p>Diastolic Dysfunction</p> <ul style="list-style-type: none"> • Both myocardial & mitral inflow E/A < 1 • Myocardial E/A < 1, mitral inflow E/A > 1 • Myocardial E/A < 1, mitral inflow E/A > 1.5 <p>Systolic Dysfunction</p> <ul style="list-style-type: none"> • Ejection fraction < 40% • End Systolic volume > 70 ml • Fractional shortening < 23% • Extensive regional wall motion abnormality 	<p>Tread Mill Test</p> <ul style="list-style-type: none"> • Exercise capacity • HRR • 1 mm ST depression <p>T- Wave</p> <ul style="list-style-type: none"> • Tall, Symmetrical, Arrow head • Inverted, Symmetrical, Arrow head • RBBB • U-Wave inversion
<p>Criteria for Diagnosis of Asymptomatic Heart Disease</p>	

Statistical Analysis

All the data and values of the investigations are incorporated in the questioner sheet and analysed statistically using SPSS software 15.0 or Epi info version 6.0 wherever applicable. The descriptive statistics like percentages were calculated. The inferential statistics like Chi square test were applied wherever applicable.

RESULTS

A total number of 253 patients were selected randomly from Diabetes Nutrition Clinic of Agartala Government Medical College & GBP hospital, Agartala for the study. There were 60.9% male & 39.1% female patients with sex ratio of 1.5:1. One hundred male and 70 female patients have AHD. The participants' age ranges from 35 to 80 years. Majority of patients belonged to age group of 45-54 years which constituting 36.4% patients. There was positive correlation with age of the majority patients with significant effect with asymptomatic heart disease (AHD). Majority of AHD in female was found in the age group of 45-54 years while majority of AHD in male was found in the age group of 55-63 years. (Table 1)

More than seventy percent (70.4%) of patients had 10 years duration of diabetes out of which 101 (56.7%) male and 77 (43.3%) patients. More than twenty seven percent (27.3%) patients had 11 to 20 years duration, 2% had duration for 20 to 30 years while 0.4% had duration for >30 years. There was positive correlation and significance of AHD with duration of diabetes. (Table 2)

Nearly thirty five percent (34.79%) patients, out of which 55.68% male and 44.31% female patients had abnormal ECG finding at rest. Majority of male patients, 21 patients having abnormal ECG finding belong to age group 56-63 years while majority female patients, 14 patients having abnormal ECG at rest belong to 45-54 age group. (Table 3)

Over all almost twenty one percent (20.9%) patients out of which 56.60% male & 43.39% female have TMT test positive. (Table 4)

More than five percent patients (5.1%) were having systolic dysfunction (SD). Over all more than twenty three percent (23.07%) patients out of which 1.19% and 3.55% had systolic dysfunction were also having abnormal ECG changes and diastolic dysfunction (DD) respectively. 131 (51.8%) patients constituting, 77 male patients & 54 female patients were having diastolic dysfunction on echocardiography. (Table 5)

In this study ECG, TMT, Echocardiography (DD) test for AHD of all the 253 patients were undertaken. On the basis of these three tests, 32.81% patients constituting 54 male and 29 female patients did not have any abnormality. Twenty-one (8.30%) patients constituting 10 male and 11 female patients were having abnormality in all three tests; ECG, TMT and Echocardiography (DD).34(13.44%) patients constituting 20 male and 14 female patients were having abnormality both in ECG and Echocardiography (DD). Six (2.37%) patients constituting 3 male and 3 female patients were having abnormality both in ECG and TMT. Twenty (7.91%) patients constituting 13 male and 7 female patients were having abnormality in TMT and Echocardiography (DD). Twenty-seven (10.67%) patients constituting 16 male and 11 female patients were having abnormality in ECG and showing TMT and Echocardiography normal. Fifty-six (22.13%) patients constituting 34 male and 22 female patients were having abnormality in Echocardiography and showing TMT and ECG normal. Six (2.37%) constituting 4 male and 2 female patients were having abnormality in TMT and showing ECG and Echocardiography normal. Nearly seventy-one (70.71%) percent of female patients were having AHD whereas 64.94% male patients were having AHD. (Table 6, Fig. 1, 2 & 3).

Age	Sex		AHD		Total, N (%)
	Male, N (%)	Female, N (%)	Male, N (%)	Female, N (%)	
35-44	33(21.4)	33(33.3)	12(12.0)	20(28.6)	66 (26.1)
45-54	53(34.4)	39(39.4)	33(33.0)	25(35.7)	92 (36.4)
55-63	51(33.1)	18(18.2)	41(41.0)	16(22.9)	69 (27.3)
64-73	15(9.7)	8(8.1)	13(13.0)	8(11.4)	23(9.1)
> 73	2(1.3)	1(1.0)	1(1.0)	1(1.4)	3 (1.2)
Total	154 (100.0)	99 (100.0)	100 (100.0)	70 (100.0)	253 (100.0)

Table 1. Age Wise Distribution of AHD and Its Correlation

Figures in () is percentage out of 253 (Total) column wise. Correlation between Age & AHD-- (+0.287) and P Value (0.000)

Duration (Years)	AHD, N (%)		No AHD N (%)	Total (%)
	Male	Female		
10	61 (61.0)	51(72.9)	66 (79.5)	178 (70.4%)
11-20	36(36.0)	17(24.3)	16 (19.3)	69 (27.3 %)
21-30	02(2.0)	02(2.8)	1(1.2)	5 (2%)
>30	01(1.0)	0(0.0)	0(0.0)	1 (0.4%)
Total	100 (100.0)	70 (100.0)	83 (100.0)	253 (100.0)

Table 2. Correlation Between Duration & AHD

Figures in () is percentage of column wise correlation between Duration & AHD-- (+0.141) and value (0.025)

ECG Changes	Number of Patients N, (%)
Anterior Wall Ischemia	28 (31.82)
Lateral Wall Ischemia	08 (9.09)
Inferior Wall Ischemia	08 (9.09)
RBBB	12 (13.64)
LBBB	02 (2.27)
VPC	06 (6.82)
Bradycardia with Non-Progressive R	04 (4.54)
Non-Specific ST-T	20 (22.73)
Total	88 (100)

Table 3. Distribution of Abnormal ECG Changes

Figures in () is percentage of column wise

TMT Changes					
ST Depression > 1 mm	ST Elevation	Arrhythmias	Bundle Branch Block	Exercise Induced U-Wave	Total Abnormal TMT Cases
31 (58.49)	12 (22.65)	02 (3.77)	6 (11.32)	2 (3.77)	53 (100)

Table 4. Distribution of Abnormal TMT Changes Among Patients

Sex	Diastolic Dysfunction		Total, N (%)
	Abnormal, N (%)	Normal, N (%)	
Male	77 (50.0)	77 (50.0)	154 (100.0)
Female	54 (54.5)	45 (45.5)	99 (100.0)
Total	131 (51.8)	122 (48.2)	253 (100.0)

Table 5. Distribution of Diastolic Dysfunction of Patients

Figures in () is percentage of row wise

Test for AHD	Sex		Total
	Male	Female	
No AHD	54 (35.1%)	29 (29.3%)	83 (32.8%)
ECG+DD+TMT	10 (6.5%)	11 (11.1)	21 (8.3%)
ECG+DD	20 (13.0%)	14 (14.1%)	34 (13.4%)

ECG+TMT	3 (1.9%)	3 (3.0%)	6 (2.4%)
DD+TMT	13 (8.4%)	7 (7.0%)	20 (7.9%)
ECG	16 (10.4%)	11 (11.1%)	27 (10.7%)
DD	34 (22.1%)	22 (22.2%)	56 (22.1%)
TMT	4 (2.6%)	2 (2.0%)	6 (2.4%)
Total	154 (100.0%)	99 (100.0%)	253 (100.0%)

Table 6. Sex Wise Distribution of Asymptomatic Heart Disease Per Test

Figures in () is percentage of column wise

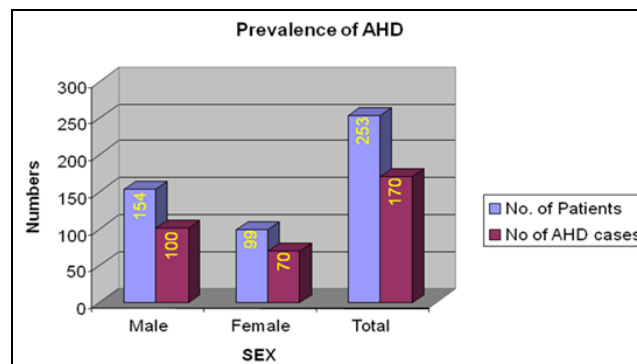


Figure 1. Prevalence of AHD. (64.93 % of AHD Patients Were Male and 70.70% Were Female.) Over All 67.19% of Patients Were Having AHD

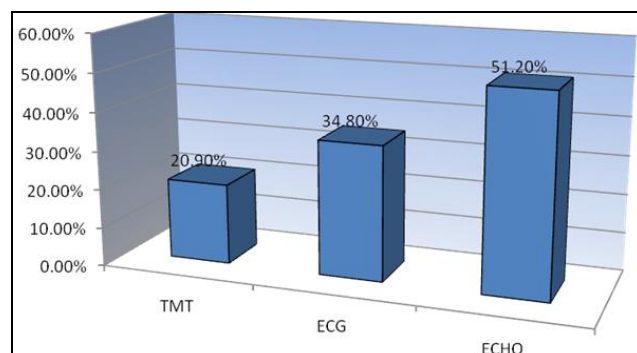


Figure 2. Percentage Distributions of AHD By Individual Test

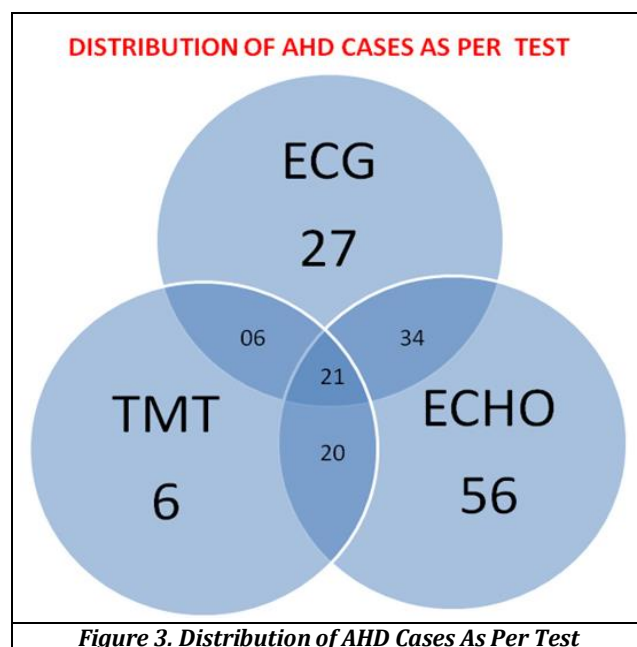


Figure 3. Distribution of AHD Cases As Per Test

DISCUSSION

In this study there were two hundred fifty-three patients who included one hundred fifty-four males and ninety nine females. The asymptomatic heart disease (AHD) was detected in one hundred seventy patients. Several large screening studies for silent myocardial disease in diabetes have been performed demonstrating variable prevalence rates from 6.4 to 58%.^{3,4} In this study 34.78% patients have ECG changes at rest. In a study comprising of 599 type II diabetic patients conducted by Premlatha G et al found that ECG changes in asymptomatic patients was 27.87%. In this study 20.94% patients had TMT positive. Baqcci et al in 2002 in screening for silent myocardial ischemia in asymptomatic type 2 diabetic patients found exercise ECG test positive for ischaemia in 19% patients.⁵ Premlatha G et al showed that TMT positive test in 26.4 % asymptomatic type 2 diabetic patients having resting ECG changes.⁶ In this study it was found TMT positive test in 10.67% asymptomatic type 2 diabetic patients having resting ECG changes. They also found TMT positive test in 11.4% asymptomatic type 2 diabetic patients having resting ECG normal.⁶ In this study TMT positive was found in 10.28% of asymptomatic type 2 diabetic patients having resting ECG normal. This finding was almost similar to study conducted by G Premlatha et al.⁶ Seshiah et al⁷ in a study found silent coronary ischaemia in 60% male diabetics the finding was comparable to those of separate studies conducted by Bellet et al⁸, Persson G et al⁹ and Karlefors T et al.¹⁰ It was found in this study that 64.93% male type 2 diabetic patients had AHD and this was in conformity to all those four separate studies. In this study diastolic dysfunction was found in 51.77% patients on echocardiography at rest. Bboyer JK et al¹¹ found diastolic dysfunction in 63 % patients using conventional echocardiography at rest. Paul Poirier et al³ found left ventricular diastolic dysfunction in 60% patients with normotensive well controlled type 2 diabetic patients. Shrestha NR et al¹² found diastolic dysfunction in 60% patients in asymptomatic type 2 diabetic patients. Bajraktari et al¹³ Claudia M et al¹⁴ in 2007 stated that left ventricular diastolic dysfunction represents the earliest pre-clinical manifestation of dysfunction in asymptomatic type 2 diabetic patients. Tsujino T et al¹⁵ observed diastolic dysfunction in 40% of patients with diabetes mellitus & correlates with poor glycaemic control.

In our study diastolic dysfunction was found in 51.8% of asymptomatic type 2 diabetic patients and this was almost in accordance of studies conducted by Bboyer JK et al¹² Paul P et al,³ Shrestha NR et al,¹² Bajraktari et al¹³ and Tsujino T et al. Claudia M, et al¹⁴ stated that diabetes might be doing asymptomatic & causing harm to heart, even in those with no known manifestations of cardiac complication but show some degree of diastolic dysfunction early.

Majority of diastolic dysfunction was found in male in the age group of 55-64 years while in female in the age group of 45-54 years, that was 10 years earlier than male counterpart. Seshiah et al⁷ in a study found silent coronary ischaemia in 60 % male diabetics. It was found in our study that 64.93% male type 2 diabetic patients have AHD.

It was found in our study that 20.95% type 2 diabetic patients have AHD on treadmill test.

Claudia MV et al¹⁴ stated that diabetes might be asymptomatic & continuously harming to heart, even in

those with no known manifestation of cardiac complication but show some degree of diastolic dysfunction early. They also recommended that diastolic dysfunction screening test for cardiovascular impairment in Type 2 diabetic patients. Mishra TK et al¹⁶ stated that a asymptomatic diabetic patients have reduced left ventricular systolic & diastolic functions as compared to healthy subjects. Left ventricular systolic & diastolic abnormalities were correlated with the duration of diabetes. It was concluded that diabetes mellitus was the strongest independent correlate of left ventricular diastolic dysfunction.

In this study higher incidence (41%) of AHD cases was found in male within the age group of 55-63 years and 35.71% in among female was found within the age group of 45-54 years. Singh MM et al found that the higher incidence of ischaemic heart disease in the age group of 41-60 years.

This study showed that positive correlation (+0.287) with age and AHD (=0.000). The risks of AHD in the age group 64-73 higher than others. In a study conducted by Meenu et al reported that there was significant correlation between duration of diabetes mellitus and coronary artery diseases.¹⁷ In this study there was a significant positive correlation observed between duration of diabetes and AHD (C.C=0.141, p=0.025).

Limitation

As it is a hospital-based study extrapolation is not possible and this may not be representatives of patients of all socio-economic background.

CONCLUSION

For detection of AHD, TMT and ECHO combined were more effective. Diastolic dysfunction screening test for early detection of AHD in diabetes is very important. There may be some benefit of screening by non-invasive method to diagnose AHD early in diabetes so as to prevent morbidity and mortality as CAD remains the single most common cause of death in this population. But most of the patients failed to recognize the classic symptoms of myocardial ischemia. We recommend further study involving different health institutions and follow up study.

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