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Study of prevalence of asymptomatic coronary artery disease in patients with diabetes mellitus by treadmill test

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Abstract

Introduction and Aim: Coronary artery disease (CAD) is the leading cause of death in patients with type 2 diabetes and is often asymptomatic because of silent myocardial ischemia. Periodical clinical examination and resting electrocardiogram may fail to detect coronary artery disease. Exercise electrocardiograph can identify the majority of patients likely to have significant ischaemia during their daily activities and remains the most important screening test for significant CAD.

This study was conducted to analyse the prevalence of ischemic changes in asymptomatic type 2 diabetic patients. Materials and methods: by exercise treadmill test.

This study was conducted at one of the tertiary health care centre in Bangalore, India between 2008 to 2011. This study was approved by the Ethics Committee of the Hospital. This is a cross sectional study done on 102 patients of type 2 diabetes mellitus without clinical and electrocardiographic evidence of coronary artery disease attending Medicine OPD. Patients of type 2 diabetes mellitus without clinical evidence of coronary artery disease, normal resting 12 lead electrocardiogram and without past history of IHD, CVA and hypertension who provided consent were included in the study. Patients suffering from IHD, severe Osteoarthritis, having abnormal resting ECG were excluded from the study. Data was obtained by history, relevant clinical examination and resting electrocardiogram. All of them underwent treadmill test according to modified Bruce protocol. Heart rate response to Valsalva maneuver, heart rate response to sustained handgrip and postural fall in blood pressure were the tests performed for recognition of autonomic neuropathy. The data was analyzed by using the SPSS software. The prevalence rate was expressed in terms of percentage.

Results: The prevalence of asymptomatic coronary artery disease in type 2 diabetes mellitus was found to be 31.37%. Among diabetic patients with Autonomic neuropathy, TMT was positive in 12 patients and negative in 8 patients (60 Vs 40%).

Conclusion: This study stresses the need of evaluation of Diabetic patients with exercise thread mill test for detecting asymptomatic coronary artery disease so that early intervention can reduce the morbidity.

Keywords: Coronary artery disease, Diabetes mellitus, Treadmill test, Autonomic neuropathy

Introduction

Diabetes mellitus is accepted as a worldwide epidemic with an estimated increasing prevalence from 2.8% in 2000 to 4.4% by 2030 ^[1]. India is presently estimated to have 41 million individuals affected by this deadly disease, with every fifth diabetic in the world being an Indian ^[2].

Coronary artery disease (CAD) is more common in diabetics and it is the leading cause of death in patients with type 2 diabetes and is often asymptomatic because of silent myocardial ischemia. The prevalence of CAD in our country varies from 23- 65/1000 in males and 17-48/1000 in females making it a major cause of morbidity and mortality ^[3, 4]. About three-quarters of the cardiovascular deaths from diabetes result from coronary artery disease. The association between diabetes and asymptomatic coronary artery disease has been attributed to an autonomic neuropathy ^[5]. CAD can be asymptomatic in diabetes and may present with sudden death, myocardial infarction, arrhythmia, silent myocardial ischemia or heart failure. Early detection of asymptomatic CAD in type 2 diabetes may prevent catastrophic cardiac events.

Periodical clinical examination and resting E.C.G. (Electrocardiogram) may fail to detect coronary artery disease. Hence sophisticated cardiovascular non invasive tests should then be proposed for early detection of CAD in these patients. Exercise electrocardiogram can identify the majority of patients likely to have significant ischaemia during their daily activities and remains the most important screening test for significant CAD [6].

Aim of the study

This study was conducted to analyses the prevalence of ischemic changes in symptomatic type 2 Diabetic patients by exercise treadmill test (TMT).

Materials and methods

This study was conducted in one of the tertiary health care centre of Bangalore, India, between 2008 and 2011. This study was approved by the Ethics committee of the Hospital. This is a cross sectional study on the patients of type 2 diabetes mellitus without clinical and electrocardiographic evidence of coronary artery disease attending diabetic Clinic, cardiology and medicine outpatient departments. Total of 102 patients were included in the study.

Patients of type 2 diabetes mellitus without clinical evidence of coronary artery disease, normal resting 12 lead electrocardiogram and without past history of ischaemic heart disease, cerebrovascular accidents and hypertension who provided consent were included in the study. Patients suffering from myocardial Infarction, unstable angina, renal disease, febrile illnesses, severe osteoarthritis or other disabilities, having abnormal resting ECG and who did not provide consent were excluded from the study.

Data was obtained by personal interaction, relevant clinical examination and resting Electrocardiogram. All of them

underwent treadmill test according to modified Bruce protocol [7].

Heart rate response to valsalva maneuver, heart rate response to sustained handgrip and postural fall in blood pressure were the tests performed for clinical recognition of autonomic neuropathy [8].

Statistical Analysis

The data was analyzed by using the SSP software and the statistical significance was estimated. The prevalence rate was expressed in terms of percentage. The Chi square test was used to estimate the statistical significance. A P-value < 0.05 was considered significant.

Results

A total number of 102 cases of type 2 diabetes mellitus without clinical and electrocardiographic evidence of ischaemic heart disease were studied and following observations were noted.

Demographic characteristics are shown in table 1 and figure 1. Among 102 patients including both male and female sex, 74 patients (72.54%) were in age group of 36 to 55 years.

Regarding the duration of diabetes mellitus, in our study population, 61 (59.8%) patients were suffering from diabetes mellitus for less than 5 years. The results are shown in table 2 and figure 2. In case of TMT results, table 3 and figure 3 shows the prevalence of asymptomatic coronary disease in the study population.

Among 102 patients, TMT was positive in 32 (31.37%) and TMT was negative in 70 (68.63%) patients. Out of 32 positive cases 19 (26.03%) were males and 13 (44.83%) were females. Among diabetic patients with Autonomic neuropathy, TMT was positive in 12 patients and negative in 8 patients. The results are shown in table 4 and figure 4.

Table 1: Age and sex wise distribution

Age Group	Total	Male	Female
26-35	13	10	3
36-45	42	32	10
46-55	32	21	11
56-65	15	10	5
Total	102	73	29

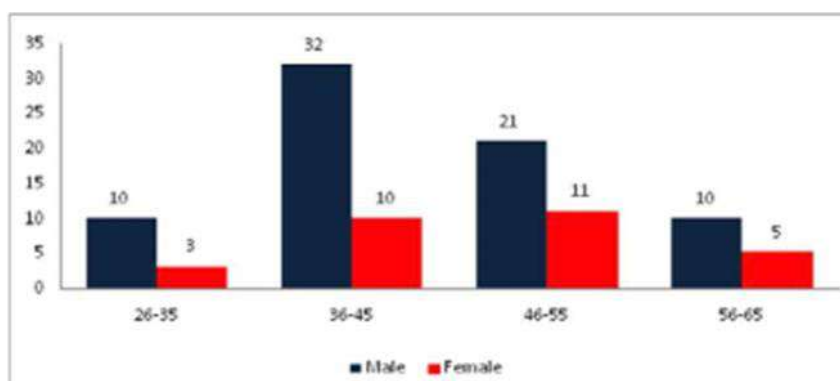
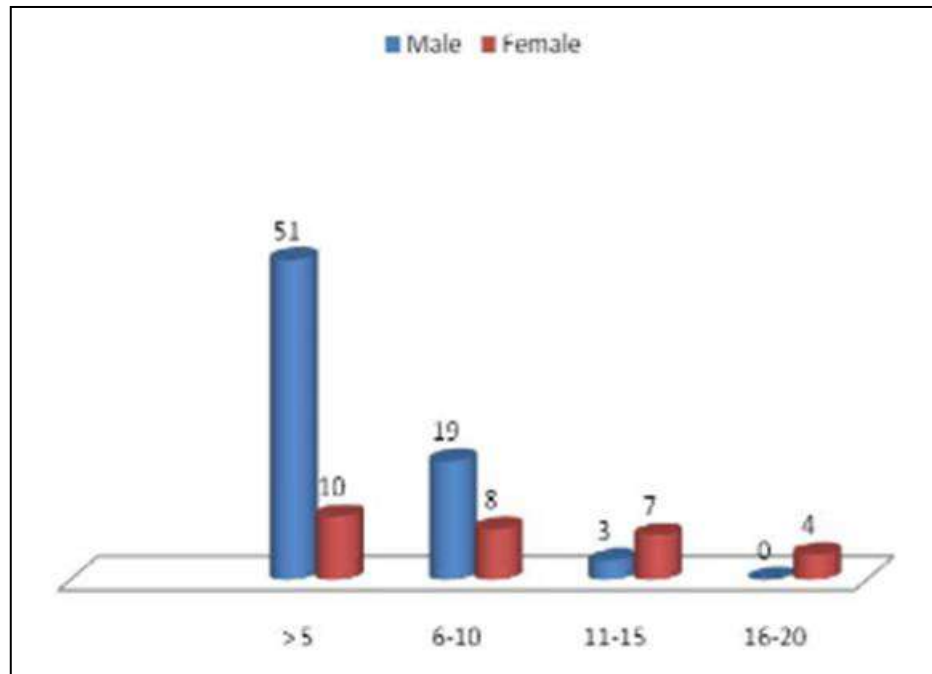


Fig 1: Age and sex wise distribution

Table 2: Duration of diabetes mellitus

Duration of Diabetes (years)	Male	Female	Total n=102
> 5	51	10	61
6-10	19	8	27
11-15	3	7	10
16-20	0	4	4
Total	73	29	102

p- value <0.0001.

**Fig 2:** Graphical representation of distribution of duration of diabetes and sex**Table 3:** TMT results based on sex

SEX	Positive	%	Negative	%	Total
Male	19	26.03	54	73.97	73 (100%)
Female	13	44.83	16	55.17	29(100%)
Total	32	31.37	70	68.63	102(100%)

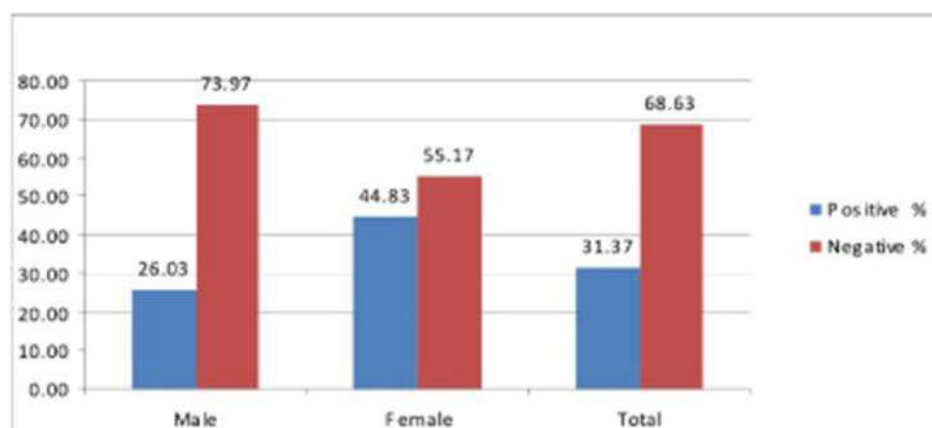
**Fig 3:** TMT results based on sex

Table 4: TMT results with and without diabetic autonomic neuropathy

Diabetic patients	TMT Positive (n=32)	TMT Negative (n=70)	TOTAL (n=102)
With Autonomic Neuropathy	12(60%)	8(40%)	20(100%)
Without Autonomic Neuropathy	19(23.17%)	63(76.83%)	82(100%)

p- value = 0.0012(<0.05)

Discussion

India leads the world today with the largest number of diabetics in any given country.

Coronary artery disease is a common cause of premature morbidity and mortality in diabetics. Evaluation of asymptomatic coronary artery disease in them is always a key issue. Early detection of coronary artery disease is therefore of paramount importance. Myocardial ischaemia may be asymptomatic or silent in a patient with diabetes mellitus. Of the total ischaemic episodes, only 20 to 30% are symptomatic and remaining 60 to 70% are silent, popularly known as silent myocardial ischemia (SMI). The association between diabetes and asymptomatic coronary artery disease has been attributed to an autonomic neuropathy^[5].

Autonomic neuropathy may lead to ischaemia or infarction by several ways. Autonomic neuropathy may occur due to increased myocardial demand for oxygen and heart rate, by reducing myocardial blood flow by increasing coronary vascular tone at the site of the coronary stenosis and by reducing coronary perfusion pressure during orthostatic hypotension^[9-11]. The occurrence of cardiac autonomic neuropathy dampens symptomatic episodes, making detection of silent myocardial ischemia more crucial.

Clinical coronary artery disease is evaluated by meticulous history, physical examination besides several tests such as Resting ECG, Ambulatory ECG monitoring,

One study^[12] in India found 38.3% to have silent myocardial ischemia with a greater prevalence in those with autonomic neuropathy (59%) than those without it (20%).

Conclusion

The prevalence of asymptomatic coronary artery disease in type 2 diabetes mellitus is 31.37%. Out of TMT positive patients, 26.03% were males and 44.83% were females reflecting higher preponderance of asymptomatic coronary artery disease towards female type 2 diabetics. Average age in TMT positive and negative cases was 53.84 and 42.43yrs respectively.

There is higher incidence of asymptomatic coronary artery disease in patients of Diabetics with autonomic neuropathy. This study stresses the need of evaluation of Diabetic patients with exercise thread mill test for detecting asymptomatic coronary artery disease so that early intervention can reduce the morbidity. An aggressive and early screening of patients with type 2 diabetes mellitus for the evidence of asymptomatic coronary artery disease may prevent catastrophic cardiac events.

References

1. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030, *Diabetes Care*. 2004;27(5):1047-53.
2. Huerta ME, Rayo Y, Lara JI, Cuéllar L, de la Calle H, Romero J *et al*. Silent myocardial ischemia during holter monitoring in patients with diabetes mellitus, *Rev Esp Cardiol* 1989;42(8):519-29.
3. Sarvothan SG and Berry JN. Prevalence of coronary heart disease in an urban population in northern India *Circulation*. 1968;37:839-46
4. Dewan BD, Malhotra KC, Gupta SP. Epidemiological study of coronary heart disease in a rural community in Haryana, *Indian Heart J*. 1974;26:68-78.
5. Zipes PD, Libby P, Bonow OR, Mann DL, Braunwald E. Diabetes and Heart disease. Braunwald's Heart Disease, A textbook of Cardiovascular medicine, 8th Edition, Philadelphia, WB Saunders company, 2008, 1558.
6. Marwick TH, Sada, M Detrano R. Screening of CAD, Cardiac Stress testing and imaging: Seventh edition, Churchill Living Stone, 2005, 126.
7. Ellestad, MH, Startt Selvester, RH, Mishkin, FS, James FW. Stress testing protocol, *Stress Testing: Principles and Practice*, fifth edition, oxford university press, 2003, 141-42.
8. Seshiah V. Diabetic Neuropathy, A Handbook of diabetes mellitus, 2nd edition: All India Publishers and Distributors, 2005, 187-89.
9. Jacoby RM, Nesto RW. Acute myocardial infarction in the diabetic patient: Pathophysiology, clinical course and prognosis, *Journal of the American college of cardiology*, 1992;20(3):736-44.
10. 10. Fein, F and Scheuer, J In: H Rifkin and D Porte Jr., Editors, *Heart disease in diabetes mellitus: theory and practice*, Elsevier, New York, 1990 : 812-23.
11. Barrett-Connor E and Orchard T. Insulin dependent diabetes mellitus and ischemic heart disease, *Diabetes Care* 1985;8:65-70.
12. Kannel WB, Anderson K, McGee DL, Degatano LS, Stampfer MJ. Nonspecific electrocardiographic abnormality as a predictor of coronary heart disease: The Framingham Study, *Am Heart J*. 1987;113:370-376.
13. Whincup PH, Wannamethee G, Macfarlane PW, Walker M, Shaper AG. Resting electrocardiogram and

- risk of coronary heart disease in middle-aged British men, *J Cardiovasc Risk*. 1995;2:533-543.
14. Garcia. MJ. *Non Invasive Cardiovascular Imaging: A Multimodality approach* Lippincott Williams & Wilkins, 176.
 15. Bruce RA, Blackmon JR, Jones JW, Strait G. Exercise testing in adult normal subjects and cardiac patients *Pediatrics*. 1963;32(Suppl):742-56.
 16. Motoji N. Silent myocardial ischemia in patients with NIDDM as judged by treadmill exercise testing and coronary angiography *Am Heart J*. 1991;123:46.
 17. Gupta SB, Pandit RB. Silent myocardial ischemia and cardiac autonomic neuropathy in diabetes, *Indian Heart J*. 1993;44(4):227-9.
 18. Sukhija R, Chanwal D, Gambhir DS, Dewan R. Silent myocardial ischaemia in patients with type II diabetes mellitus and its relation with autonomic dysfunction, *Indian Heart J*. 2000;52(5):540-6.
 19. Achari V, Thakur AK. Treadmill Testing in Asymptomatic Type 2 Diabetes *JAPI*. 2002;50:52.
 20. Quek DK. Association of diabetic autonomic neuropathy and painless myocardial ischemia induced by exercise, *Singapore Med J*. 1992;32(2):177-81.
 21. Murray DP, O'Brien T, Mulrooney R, O'Sullivan. Autonomic dysfunction and silent myocardial ischemia on exercise testing in diabetes mellitus *Diabetic Med*. 1990;8(7):580.
 22. Gupta SB, Pandit RB. Silent myocardial ischemia and cardiac autonomic neuropathy in diabetes *Indian Heart J*. 1993;44(4):227-9.