Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2017; 5(5A):1735-1738 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2017.v05i05.005

Original Research Article

Heart rate recovery during treadmill test in Silent Myocardial ischemic and non-ischemic type 2 Diabetes patients

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Abstract: Myocardial ischemia occurs when myocardial oxygen supply cannot meet myocardial oxygen demand. Silent Myocardial Ischemia (S.M.I.) is defined as objective documentation of myocardial ischemia in the absence of angina or angina equivalents. Heart rate recovery can be defined as the rate at which the HR declines from either maximal or submaximal exercise to resting levels. The present study compare the heart rate recovery at 1 minute post-exercise in S.M.I. and non ischemic type 2 diabetes patients during T.M.T.150 type 2 diabetic patients were taken and they undergone T.M.T. Present study observed that heart rate recovery in S.M.I. group was significantly lower than heart rate recovery in non-ischemic group. So it can be concluded that slow heart rate recovery in S.M.I. group could be due to autonomic nervous system dysfunction.
Keywords: Silent Myocardial Ischemia, Heart rate recovery, autonomic nervous system dysfunction

INTRODUCTION

Diabetes rates are rising in South-East Asia, with India and rest of South East Asia contributing for the major burden, 65 and 72 million respectively, accounting for about one-fifth of all cases worldwide [1]. Coronary Artery disease (CAD) is the major cause of morbidity and mortality in patients with diabetes [2-4].

Myocardial ischemia occurs when myocardial oxygen supply cannot meet myocardial oxygen demand. The main cause is usually obstructive atheromatous plaque in the epicardial coronary arteries. Inadequate perfusion results in conversion from aerobic to anaerobic metabolism, diminished myocardial contraction and electrophysiological changes [5-7]. Silent myocardial ischemia (S.M.I.) is defined as objective documentation of myocardial ischemia in the absence of angina or angina equivalents [8].

Heart rate recovery can be defined as the rate at which the HR declines from either maximal or submaximal exercise to resting levels and has been identified as important and independent predictor of cardiovascular and all-cause mortality in healthy adults and diabetics [9-11]. Recovery of the heart rate immediately after exercise (1 min) is mediated by vagal reactivation with poor and slow heart rate recovery (HRR) being a predictor of all-cause mortality and sudden death.

MATERIALS AND METHODS

The study had been conducted in C.T.M.T cell of S.M.S. Hospital of Department of Cardiology and Department of Endocrinology, SMS Medical College and Hospital, Jaipur. 150 type 2 diabetic subjects of either sex had undergone treadmill test (T.M.T) according to inclusion and exclusion criterion. Subjects were classified as exercise induced myocardial ischemia on the basis of down sloping or horizontal depression in ST-segment of T.M.T report. Subjects having down sloping or horizontal depression in ST-segment > 1mm without experiencing pain were considered as Silent myocardial ischemia and cases with no down sloping or horizontal depression in ST-segment were considered as non-ischemic cases. Proportion of cases with Silent

Myocardial Ischemia in total cases and Heart rate recovery after 1minute exercise in Silent myocardial ischemia cases and non-ischemia cases were compared and analysed according to Chi square test and unpaired‘t’ test.

RESULTS:

Table-1 shows that the proportion of Silent Myocardial Ischemia (SMI) in patients of type 2 Diabetes Mellitus cases is 38%.

Table-2 shows that mean resting Heart rate was higher in Diabetic patients in SMI group (92.02 beats /min) as compared to Non Ischemic group (79.86 beats/min), and application of t test showed that this difference was statistically significant (P<0.001).

Table-3 shows that mean recovery of Heart rate at one minute following exercise was lower in Diabetic patients in SMI group (15.58 beats /min) as compared to Non Ischemic group (28.48 beats/min), and application of t test showed that this difference was statistically significant (P<0.001).

Table 1: Distribution of study population according to Presence of SMI

ECG finding	N	Percentage
SMI	57	38
Non Ischemic	93	62
Total	150	100

Table 2: Comparison of mean Resting HR in SMI and Non Ischemic group

Group	N	Mean	Std. Deviation
SMI	57	92.02	11.94
Non Ischemic	93	79.86	12.16

t = 5.984 at df 148; P<0.001

Table 3: Comparison of mean recovery of HR in SMI and Non Ischemic group

Group	N	Mean	Std. Deviation
SMI	57	15.58	10.61
Non Ischemic	93	28.48	10.92

t = 7.101 with 148 degrees of freedom; P = 0.000; P<0.001

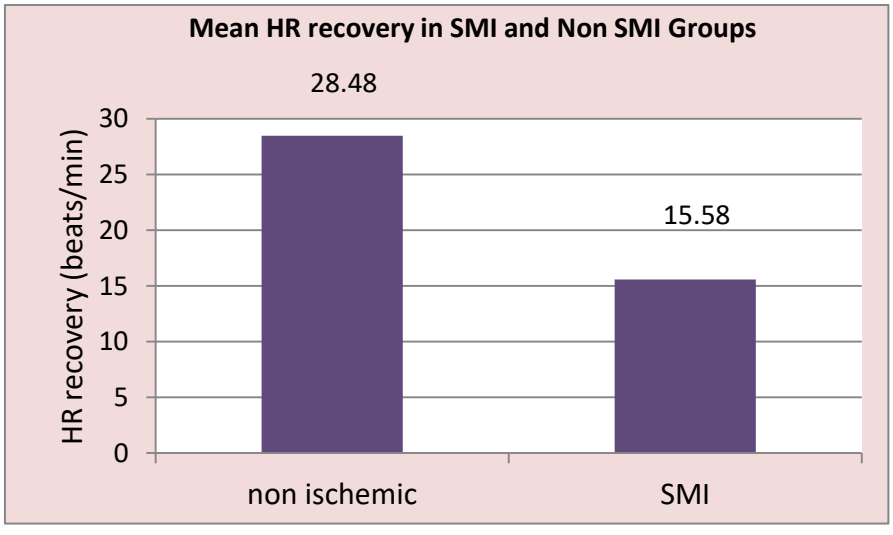

Fig-1: Mean HR recovery in SMI and Non SMI Groups

DISCUSSION

Several mechanisms are involved in the SMI genesis. Endothelial dysfunction secondary to DM leads to an inappropriate coronary flow response to increasing myocardial metabolic needs (coronary vascular tone abnormality). It is also due to an increased pain

sensation threshold in diabetic patients, probably due to an elevated beta-endorphins rate. These two abnormalities are associated with an impaired autonomic nervous system. The prevalence of SMI in the diabetic population is much variable in the different studies, ranging from 12% to almost 57% [12, 13]. It is 3 to 6 fold higher than in asymptomatic non-diabetic population [12]. This wide prevalence variation of SMI in patients with DM is in part due to the population selection, which is not homogeneous in regard of the cardiovascular risk status and due to some confounding factors. This variability underlines the difficulty to have a cost-effective screening and the absolute necessity to define a high cardiovascular risk asymptomatic diabetic population likely to fully benefit from this screening. Silent myocardial ischemia is associated with a poor prognosis, with a 3- to 4-fold increase of cardiovascular events rate in case of SMI [13].

The combined effect of sympathetic activation and vagal withdrawal during exercise leads to increase in heart rate. These autonomic changes are mediated by both somatic exercise reflexes and central command mechanisms. After stopping of exercise the increased heart rate decreases rapidly. This rapid recovery appears to be an important mechanism for avoiding excessive cardiac work after exercise. Although autonomic nerve mechanisms of the rapid heart rate recovery needs further research, several lines of evidence have suggested that vagal reactivation plays an important role. The mechanisms of adverse outcome associated with abnormal heart rate recovery are likely abnormalities in parasympathetic activation [14-15].

CONCLUSION

Type 2 diabetes patients with SMI have high resting heart rate and mean heart rate recovery at 1 minute post-exercise was lower in SMI group of diabetic patients than in non-ischemic group of diabetic patients which could be due to autonomic nervous system dysfunction.

REFERENCES

1. Atlas ID. International Diabetes Federation: Brussels. 2011.
2. Dinneen SF, Gerstein HC. The association of microalbuminuria and mortality in none—insulin-dependent diabetes mellitus: a systematic overview of the literature. Archives of internal medicine. 1997 Jul 14; 157(13):1413-8.
3. Manske CL, Wilson RF, Wang Y, Thomas W. Prevalence of, and risk factors for, angiographically determined coronary artery disease in type I-diabetic patients with nephropathy. Archives of internal medicine. 1992 Dec 1; 152(12):2450-5.
4. Muhlestein JB, Lappé DL, Lima JA, Rosen BD, May HT, Knight S, Bluemke DA, Towner SR, Le V, Bair TL, Vavere AL. Effect of screening for coronary artery disease using CT angiography on mortality and cardiac events in high-risk patients with diabetes: the FACTOR-64 randomized clinical trial. Jama. 2014 Dec 3; 312(21):2234-43.
5. Weiner DA, Ryan TJ, Parsons L, Fisher LD, Chaitman BR, Sheffield LT, Tristani FE. Significance of silent myocardial ischemia during exercise testing in patients with diabetes mellitus: a report from the Coronary Artery Surgery Study (CASS) Registry. The American journal of cardiology. 1991 Sep 15; 68(8):729-34.
6. Zellweger MJ, Hachamovitch R, Kang X, Hayes SW, Friedman JD, Germano G, Pfisterer ME, Berman DS. Prognostic relevance of symptoms versus objective evidence of coronary artery disease in diabetic patients. European Heart Journal. 2004 Apr 1; 25(7):543-50.
7. Zellweger MJ, Weinbacher M, Zutter AW, Jeger RV, Mueller-Brand J, Kaiser C, Buser PT, Pfisterer ME. Long-term outcome of patients with silent versus symptomatic ischemia six months after percutaneous coronary intervention and stenting. Journal of the American College of Cardiology. 2003 Jul 2; 42(1):33-40.
8. Cohn PF, Fox KM, Daly C. Silent myocardial ischemia. Circulation. 2003 Sep 9; 108(10):1263-77.
9. Cole CR, Blackstone EH, Pashkow FJ, Snader CE, Lauer MS. Heart-rate recovery immediately after exercise as a predictor of mortality. New England Journal of Medicine. 1999 Oct 28; 341(18):1351-7.
10. Cole CR, Blackstone EH, Pashkow FJ, Snader CE, Lauer MS. Heart rate recovery immediately after exercise as a predictor of mortality. Journal of Cardiopulmonary Rehabilitation and Prevention. 2000 Mar 1; 20(2):131-2.
11. Nishime EO, Cole CR, Blackstone EH, Pashkow FJ, Lauer MS. Heart rate recovery and treadmill exercise score as predictors of mortality in patients referred for exercise ECG. Jama. 2000 Sep 20; 284(11):1392-8.
12. on Atherosclerosis MS. Prevalence of Unrecognized Silent Myocardial Ischemia and Its Association With Atherosclerotic Risk Factors in Noninsulin-Dependent Diabetes Mellitus. The American Journal of Cardiology. 1997 Jan 15; 79(2):134-9.
13. Vanzetto G, Halimi S, Hammoud T, Fagret D, Benhamou PY, Cordonnier D, Denis B,

Machecourt J. Prediction of cardiovascular events in clinically selected high-risk NIDDM patients. Prognostic value of exercise stress test and thallium-201 single-photon emission computed tomography. Diabetes Care. 1999 Jan 1; 22(1):19-26.

14. Forjaz CL, Matsudaira Y, Rodrigues FB, Nunes N, Negrão CE. Post-exercise changes in blood pressure, heart rate and rate pressure product at different exercise intensities in normotensive humans. Brazilian Journal of Medical and Biological Research. 1998 Oct; 31(10):1247-55.
15. Okutucu S, Karakulak UN, Aytemir K, Oto A. Heart rate recovery: a practical clinical indicator of abnormal cardiac autonomic function. Expert review of cardiovascular therapy. 2011 Nov 1; 9(11):1417-30.