

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

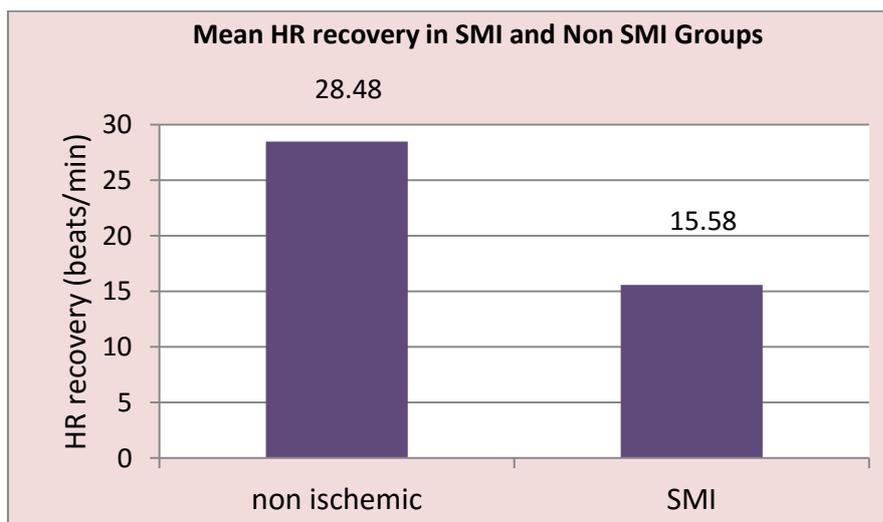


Fig-1: Mean HR recovery in SMI and Non SMI Groups

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.

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