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EXERCISE ECG TESTING USING DIFFERENT PROTOCOLS IN ASYMPTOMATIC HEALTHY YOUNG SUBJECTS

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Abstract : Thirty four healthy young male subjects performed symptom limited exercise on Bruce protocol on treadmill machine. Hyperventilation induced labile repolarisation ST–T abnormalities were observed in 2 whereas exercise induced ST changes (upsloping ST depression in 4 and horizontal ST depression in 1) were observed in 5 additional candidates. Changes were unaccompanied by symptoms or signs and quickly reverted back to normal within 30 sec. of cessation of exercise and hence were `probable false positives'. Sixty eight age and sex matched volunteers (including former 34) when exercised on Master's stepper, failed to reveal any change probably due to the lack of continuous ECG monitoring device.

Key words : exercise testing, treadmill, master's stepper, healthy subjects

INTRODUCTION

The era has begun where one tries to prevent the disease or wish to detect it at a very early stage. Performing exercise stress testing in otherwise asymptomatic healthy population is also an effort in the same direction. One lands into dilemma if faced with the changes suggestive of myocardial ischaemia in such an individual. Subsequent angiographic studies, whereas have proved lot many of these changes as false positive but simultaneously have also demonstrated organic lesions in a significant number of this population as well (1). Females outnumber males and no age has been found to be spared (2, 3, 4, 5). Different exercise tests using different protocols have been suggested from time to time to rule out these false positives without much success. It was in this context that the present study was planned to screen and compare a cohort of much younger population on 2 different exercise protocols for the prevalence of such changes.

METHODS

Thirty four asymptomatic, healthy, medical students (all male, mean age 24 ± 3 years) were asked to perform symptom limited exercise on Bruce protocol on Marquetts Treadmill (TMT) machine equipped with continuous, computerised ECG monitoring. Achievement of target heart rate (THR), symptoms (fatigue,

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shortness of breath, chest pain) or a positive ECG response were the criteria for termination of the test. 12–lead ECG trends with rhythm strips were recorded at every 3 minute intervals including 6 minutes of recovery. ST segment analysis was performed at 80 msec after the junction (J) point.

Exercise test was repeated in these volunteers and 34 additional age and sex matched students on Master's Stepper (MST) having 2 steps each for ascent and descent, each 23 cm high and 25 cm wide. Candidates were asked to begin exercise at 60 paces per minute (10 ascents and descents) increased gradually to 90, 120 and 150 paces at every 4 min intervals. Pre and post exercise ECGs were obtained with BPL 108T portable mannual ECG machine. Reasons for termination were same as above.

RESULTS

On TMT, hyperventilation induced T–inversion and horizontal ST–depression (in inferior leads, maximum 0.6 mm in lead III) were observed in one candidate each. Changes normalised within 30 seconds of beginning of exercise. Exercise induced ST changes were observed in 5 additional candidates as rapid upsloping (> 1 mm/sec), 0.5–1.0 mm.ST segment depression in 4 and horizontal 2 mm ST–depression in 1 candidate respectively (Fig. 1). These appeared during 3rd stage of exercise and after achieving 85% of THR in all of them. Changes quickly reverted back to baseline within 30 sec of cessation of exercise.

Maximum HR that could be recorded after MST was 70% of THR and ST segment deflection of > 0.5 mm was not observed in any candidate in immediate post exercise or recovery ECG.

DISCUSSION

The prevalence of an abnormal exercise ECG response has been reported to range from 1.2 to 23% in asymptomatic males and even more in females (2–6) Such a wide variation is probably due to varying age groups and other functional characteristics of the cohort under study and of more practical significance because of the variable criteria selected to label the ST–segment changes as abnormal (6). A meta–analysis of 147 consecutive published reports involving 24, 074 patients reported that the decreased specificity of positively labelled tests is primarily due to the classification of upsloping ST–segment depression as abnormal. It has been suggested that the shortening of ORS interval and elongation of atrial repolarisation wave (Ta wave) during maximal exercise makes the Ta–wave to lie over the J–point and initial ST–segment, so as to produce an upsloping ST–depression patterns which is chiefly reflected in infero–lateral leads (5). A rapid upsloping ST segment (> 1 mm/sec) depressed < 1.5 mm at 80 msec after the J–point are now increasingly being considered as normal (7) and it is only a depression of > 2 mm of such type, which should be labelled abnormal (8).

The overall prevalence of ST–segment changes in the present study is 14.8% (5 of the 34). When analysed critically in the light of aforementioned facts, 4 of these 5 were actually the rapidly upsloping ST depressions, which as per the consensus should be labelled as normal.

One candidate revealed horizontal ST depression that too of > 2 mm magnitude at 80 msec after the J–point is definitely an abnormal response as far as its morphology is being considered. The changes of even such a magnitude in an otherwise healthy man are suggested to be `atypical' until these appear at low work loads, persists for several minutes and/or accompanied by inappropriate HR or BP responses or chest pain (8). None of the mentioned criteria applies to this case. Therefore it remains very difficult to offer any universally acceptable prognostic significance to such type of changes. Moreover, as per the Baye's theorem, not much importance can be ascribed to these changes as a predictor of coronary disease in view of very low (< 25%) predictive value of coronary artery disease in asymptomatic population (9). Angiographic studies in healthy individuals with positive exercise test have revealed only a weak positivity rate (= 8%)[1] and no significant increase in the incidence of future cardiac event has been observed in these individuals when observed for next 5–6 years (2, 10). Forecast should better be avoided in these cases unless proved otherwise.

Hyperventilation induced changes have been suggested to be labile repolarisation ST–T abnormalities' as it usually disappear with exercise.

No prognostic significance has been offered to it by previous investigators (10). Serial exercise testing have shown its presence during exercise as well, which may further complicate the picture in a cross sectional study (10).

The present study has failed to detect any post exercise ECG change after MST, even in double the number of volunteers including those who revealed positive exercise ECG on TMT. Previous studies with continues ECG monitoring have successfully recorded ECG changes after MST as well (1). Probably the lack of continuous ECG monitoring during exercise and the time elapsed between the cessation of exercise and ECG recording has helped these changes to escape from detection.

CONCLUSION

It can therefore be concluded from the above study that ST segment changes do occur in a significant number of healthy young males as well. What is required to detect these changes is a continuous ECG monitoring, whatever the mode of exercise may be performed. The low predictive value of disease in healthy young population and results of the previous studies suggests these changes to be nonspecific. In absence of abnormal haemodynamic response and/ or chest pain or other electrocardiographic features suggestive of ischaemia, these changes may be considered as nonspecific.

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