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ECG findings in young Nigerian medical students

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Abstract

Cardiovascular diseases are becoming more frequent occurrence in the third world. There are tell-tale signs that can be seen long before they occur. Thus forty volunteer medical students, comprising of 18 females and 22 males between the ages of 18 and 30 years, were assessed for cardiac fitness using ECG. All the volunteers were subjected to exercise stress test using bicycle ergometer. They exercised to exhaustion or attainment of 85% HR_{max}. ECG was recorded pre and post-exercise. The study compares the findings in the males to that of the females. Results showed that pre-exercise in males, 60% had normal ECG, 8% had sinus bradycardia, 4% sinus arrhythmia and 8% left atrial enlargement. Other findings included 4% right atrial deviation, 4% short PR interval, 4% premature ventricular contraction, 4% rare premature atrial contraction and 4% had early repolarisation. Post-exercise ECG revealed 36% normal ECG, 44% had sinus tachycardia. In the females, pre-exercise findings revealed 94.4% normal ECG and 5.6% had sinus arrhythmia. Post-exercise findings showed 66.7% normal ECG, 22.2% had sinus tachycardia, 5.6% sinus arrhythmia and 5.6% rare premature atrial contraction. Abnormal ECG findings are prevalent among young Nigerians and there is need to focus of this group to prevent cardiac events in the future.

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Introduction

Since 1999, the National Institute for Health and Clinical Excellence (NICE) uses probability to help diagnose chest pain. They ask everyone attending the rapid access chest pain clinic at the hospital to complete a questionnaire. The probability of coronary heart disease (CHD) is then calculated from this and 12 lead electrocardiography (ECG) before the person is seen (Peter 2010). That is in diseased state. Is there any use in 'normal' young subjects? Many people do not experience symptoms before a major first CHD event, such as sudden cardiac arrest, myocardial infarction, congestive heart failure, or unstable angina (Chou *et al.* 2011), so they actually go for 'normal' subjects. Though routine screening of asymptomatic individuals with exercise tests is not recommended (Fletcher *et al.,* 2001, Chou *et al.* 2011) although there is evidence that the development of an ischemic ECG response at low workloads of testing among asymptomatic men is associated with a higher relative risk of future events such as angina pectoris, myocardial infarction (MI), and sudden cardiac death (SCD), the absolute risk of cardiac events in these populations remains low (Ian 2009, Lyerly *et al.* 2010). A recent study in 6,100 asymptomatic men who were free of clinically detectable cardiovascular disease revealed that the occurrence of frequent premature ventricular depolarisations during exercise testing was associated with a long-term (25 year) increase in the risk of death from cardiovascular causes; no significant increase in shorter term risk was reported (Jouven *et al.* 2000).

However with regard to subjects who are asymptomatic but have risk factors for CAD, the results of exercise ECG testing are beneficial. In the Seattle Heart Watch Study (Bruce *et al.* 1980), men with one or more risk factors (positive family history, smoking, hypertension [blood pressure > 140/90 mm Hg], and hypercholesterolemia [total cholesterol >240 mg/dL]) and 2 abnormalities on exercise testing (chest pain, exercise <6 minutes, ST depression >1.0 mm, or <90% predicted heart rate) had a 30-fold increase in 5-year cardiac risk. Exercise testing was of no predictive value in the group with no risk factors. In the Lipid Research Clinics Coronary Primary Prevention Trial (Ekelund *et al.* 1989), hypercholesterolemic men with >1 mm of ST depression on exercise testing had a 5.7 times greater risk of death from CAD than those with a negative test. The Multiple Risk Factor Intervention Trial (Chou *et al.* 2011) reported a nearly 4-fold increase in 7-year CAD mortality among men with an abnormal exercise ECG and suggested that the exercise ECG might serve to identify high-risk men who could benefit from risk factor reduction.

Thus traditional risk factor assessment with resting or exercise electrocardiography, might help better guide use of risk-reduction therapies in asymptomatic persons without known CHD (O'Malley and Redberg 2010).

Such studies were done among young people in other part of the world (Erikssen *et al.* 2004, Denes *et al.* 2007, Ian 2009, Chou *et al.* 2011, Uhm *et al.* 2011), but little has been published in this part of the world. This study will serve as a pilot study to a bigger survey in prognosticating CHD.

Materials and methods

Subjects

This study was intended for all (63) the preclinical medical student of the University of Abuja as volunteers. 40 students were eventually used after the exclusive criteria(Darrow 1999) ruled out some. These students fell within the age group of 18-30 years (Table 1). The study was approved by the ethical committee of College of Health Sciences, University of Abuja.

Procedures

Subject Preparation

All subjects gave informed consent to participate in the study. Subjects were advices to wear light clothing and take their normal feeds (lunch) before the study.

Supervising the test

There was a qualified medical personnel throughout the period of the exercise test to handle any emergency that may arise. There were also three technical staffs involved in the study. The procedure was demonstrated to all the subjects before the exercise.

The recordings were carried out according to the specifications of the American Heart Association, i.e. subjects lying supine, arms by their side, chest electrodes in their correct positions, limb electrodes on the wrists and ankles, recording at 25 mm/sec, calibrated at 10 mm/mV. The calibration was consistent.

Skin preparation and electrode placement

The skin was prepared by cleaning thoroughly with alcohol to remove the water-proof layer on the skin and allow good contact. ECG cream applied to the chest, arms and legs enhance better electrical conduction to the leads. Electrodes were positioned as recommended by the American Heart Association (Schlant *et al.* 1996). ECG recording was taken before the exercise as control and about two to three minutes after the exercise.

Exercise stress testing

This was done using bicycle ergometer (Magnetic Bike). The age-predicted maximal heart rate (HR_{Max}) was first calculated using the formula, HR_{Max} = 220 – age (Braunwald 2011). 85% (sub maximal level) of this value is calculated as the heart rate the subject aims to achieve during the stress test. Subject mounts on the bicycle and sits comfortably with the seat adjusted in such a way that there is knee flexion when the contralateral knee is fully extended. The digital monitor is reset and the resistance fixed at stage 2. The subject starts riding slowly and gradually increases the speed. Rides until he/she attains 85% of age-predicted HR_{Max} or when exhausted and cannot continue due to fatigue (modified McArdle protocol) (McArdle *et al.* 1994, Guyton and Hall 2010). Before stopping, the subject is asked to ride slowly for about 30 seconds before finally dismounting the bicycle. Subject then moves to the couch, sweat cleaned off and ECG recorded again. The room temperature at the time of study was 34°C.

Results

From the ECG tracings analyzed by a specialist cardiologist, 75% (30) of the subjects had normal ECG tracing before exercise and 25% (10) had one abnormality or the other post-exercise. The male subjects had more abnormalities before and after exercise than the female subjects (Fig.1 and 2). The commonest findings pre-exercise in males was sinus bradycardia (8%) and Left Atrial Enlargement (8%) whereas it is sinus arrhythmia (5.6%) in females. Sinus tachycardia dominates the findings post-exercise in both males (44%) and females (22.2%).

Table 1. Descriptive data of subjects.

Variables	Male (n=22)	Female (n=18)
Age (Yr)	21.41 ± 1.74	23.00 ± 3.45
Height (m)	1.77 ± 0.09	1.58 ± 0.05
Weight (kg)	67.11± 10.19	55.02 ± 6.07
BMI	21.46 ± 2.34	22.52 ±3.09

Values are mean ± SD.

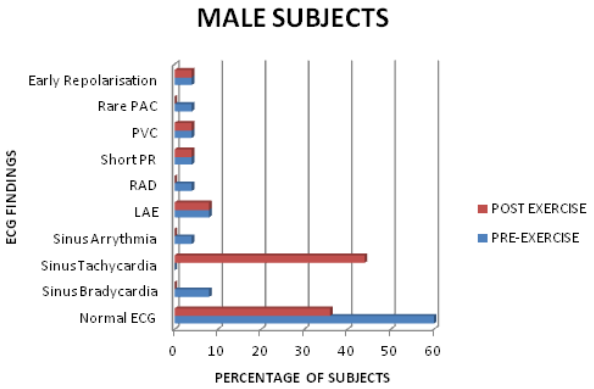

Fig. 1. ECG diagnostic findings in male subjects.

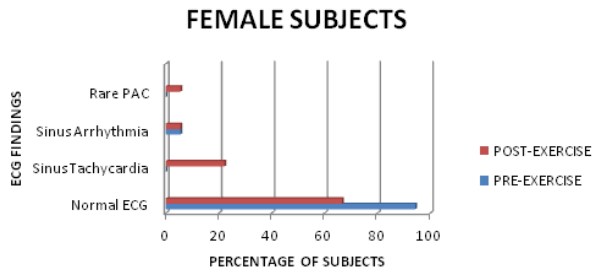

Fig. 2. ECG diagnostic findings in female subjects

Discussion

ECG findings are important in diagnosing and prognosticating CHD. But its use in healthy subjects is still debated. Many believe it has little value in asymptomatic subjects because of its high false positive result in predicting future cardiac event. But they agree that it is of great importance is asymptomatic subject with risk factor for CHD (Fletcher *et al.* 2001, Greenland *et al.* 2010, Lyerly *et al.* 2010). There is increase

incidence of cardiac and sudden cardiac death (SCD) in younger individuals (Uhm *et al.* 2011). Data are scarce in Nigeria and there is need to fill in that gap. This pilot study revealed that asymptomatic young Nigerians (18-30 years) have ECG findings that may suggest future CHD or SCD. The findings at rest are high in the males with only 60% having normal ECG findings compared to 94.4% in the females. This further support the known fact that men are more prone to cardiac diseases (Braunwald 2011). The abnormal findings included in the females before exercise was sinus arrhythmia (5.6%) and the same figure was found after exercise also. Sinus arrhythmia is found to be common in young people, especially children. It is a response to respiratory changes, thus called respiratory sinus arrhythmia. It is one of the components of heart rate variability (HRV). Several researcher have found HRV to be strong adverse prognostic indicator of cardiovascular mortality (Sin *et al.* 2010). In the male, only 4% had sinus arrhythmia pre-exercise which disappeared after exertion. Sinus tachycardia was recorded only post exercise in 44% of male and 22% of female subjects. This is a normal response to exercise, but the recovery rate is faster in the female. Men are more prone to abnormal heart rate recovery (Jolly *et al.* 2011). Sinus bradycardia was recorded in 8% of the male subjects before exercise. This is rare for young subject who are not on any medication or having cardiac pathology (Epstein *et al.* 2008). Though sinus arrhythmias with periods of sinus bradycardia and wandering atrial pacemaker are relatively common during early exercise and the immediate recovery phase (Fletcher *et al.* 2001).

We found 8% of the subjects having left atrial enlargement, not affected by exercise. 4% of the males had right axis deviation before exercise and 5.6% of the females had it only after exercise. Axis deviation may be due to right ventricular hypertrophy and can also be normal finding especially in young slim subjects (PatanÃ¨ *et al.* 2008). 4% of the male had premature ventricular contraction (PVC). Agarwal and colleagues (Agarwal *et al.* 2010) in their Atherosclerosis Risk In Communities (ARIC) Study found that there is increase risk of incident stroke in participants free of hypertension and diabetes. This suggests that PVCs may contribute to atrioventricular remodelling or may be a risk marker for incident stroke, particularly embolic stroke.

Rare premature atrial contraction, short PR and early repolarisation have all 4% in our study subjects (male) (Fig. 1 & 2). In a larger study comprising of 10,867 apparently healthy young male subjects in South Korea, Uhm (Uhm *et al.* 2011) found about 33% ECG findings suggestive of abnormal rhythm, 18% right axial deviation, 10% early repolarisation, and 6% with chamber enlargement, amongst other findings. It is becoming progressively clearer that apparently healthy young adult may not be that healthy after all.

Limitations

Because this is a pilot study and the number of subjects very few, we cannot categorically state that this is the prevalence of these ECG findings in Nigeria. Also, these tracings were taken before and after exercise. An Holter ambulatory ECG machine would have given a better picture.

Conclusion

Young Nigerians are not as free from cardiac disease as we think. The increase incidence of non-communicable disease among Sub-Saharan Africans, especially cardiovascular, needs to be taken more seriously. There is need for a nationwide survey of these findings in young Nigerians with the aim of nipping this menace at the bud. We also need to have routine basic ECG for young people enrolling into higher education, military or paramilitary training institutions.

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