ELECTROCARDIOGRAPHIC ABNORMALITIES IN A CLINICALLY NORMAL POPULATION

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ABSTRACT

Objective: *To find out the electrocardiograhic abnormalities in the normal population.*

Methodology: *The study was conducted by Cardiology Department, Lady Reading Hospital, Peshawar between January 2008 and January 2009. Individuals with different age, sex, professions and socio-economical classes were randomly selected from the general population of Peshawar. Individuals with a history of Coronary artery disease(CAD),diabetes mellitis (DM), hypertension (HTN) and known dyslipidemia were excluded from the study.*

Results: *A total of 1825 people were included in the study. A total of 307 people suffering from coronary artery disease, hypertension, diabetes mellitus, peripheral arterial disease were excluded from the study. The remaining 1518 people were included in the study. The mean age was 36.13 ± 12.38. There were 81 % males and 19% females. ECG abnormalities were noted in 74 (4.87 %) people with 8 (2.88%) females and 66 (5.48%) males. Among females the most common ECG abnormalities were ST depression and T-wave changes while in males, it was Left Ventricular Hypertrophy, followed by the detection of an old MI of which they had no recollection. Sinus bradycardia and tachycardia was also seen in a number of male subjects. Total of 1444 study subjects were labeled as normal, among whom 891 (61.8 %) were less than 40 years of age and 550 (38.2%) were above 40 years of age.*

Conclusion: *ECG abnormalities are not uncommon in our normal population. ECG is an easily available and cost effective tool for screening cardiac abnormalities.*

Key Words: *Electrocardiograpghy, Screening.*

INTRODUCTION

Global burden of Cardiovascular Disease (CVD) has alarmingly increased, making it the leading cause of morbidity and mortality worldwide. Although majority of patients with CVD are diagnosed still a big number remain undetected as they are either asymptomatic or have non-specific symptoms. A careful history and a good clinical examination is the hallmark of cardiac evaluation. Resting electrocardiogram (ECG) has proved itself as a diagnostic tool of great utility which unmask the disease not only in symptomatic but also in apparently healthy population[1,2]. A lot of work has been done in normal population mostly young competitive athletes undergoing pre-participation cardiac evaluation. Resting ECG abnormalities which are noted in normal population may be independently associated with cardiovascular disease events without clinically manifest heart disease. Apart from its use in clinical context, ECG has been employed as prognostic tool in otherwise healthy individuals[3-15]. Baseline minor and major abnormalities and development of new changes during follow up would be associated with increased incidence of coronary artery disease (CAD) and CVD outcome, independent of traditional risk factors. ST and T wave changes may not always be significant to meet the criteria of CAD and CVD, they are usually labeled as nonspecific ST,T changes. Besides this conduction defects, arrhythmias, pre-excitation, left and right

ventricular hypertrophy can be incidentally detected in an otherwise healthy individual & an underlying possibility of Cardiomyopathy, Rheumatic Heart Disease, CAD or congenital anomalies. After thorough search we could not find any local study on the incidence and prevalence of ECG abnormalities in our population. This study was planned to find out the p revalence of ECG abnormalities in the normal population of in and around Peshawar.

METHODOLOGY

This study was conducted by Cardiology Department, Post Graduate Medical Institute Lady Reading Hospital, Peshawar as part of "Peshawar Heart Study" between January 2008 and January 2009. Study population was randomly selected from doctors, nurses, teachers, lawyers, sweepers, secretariat staff, bakers, jail staff, prisoners and journalists of Peshawar. Individuals with a history of CAD, diabetes mellitus (DM), hypertension (HTN) and known dyslipidemia were excluded from the study. Each individual gave a written informed consent for participation in the study. Each participant was interviewed and asked predesigned questions including information regarding their personal details, previous medical, drug and family history. Details were recorded on a questionnaire. A 12 lead ECG was obtained for all study subjects with a Cardiofax ECG machine by a trained ECG technician. ECG was interpreted by two cardiologists who were unaware of the study design, gender and age of the patients.ECG was reported positive for an abnormality based on the pre-specified criteria as shown in Table 1.

ECG abnormalities were further classified according to different conditions as specified in Table 2.

Table 1: Criteria for a 12 lead ECG [16]

P wave	Left atrial enlargement : negative p in lead V1, 0.1 mV in depth and ≥ 0.04 in duration. Right atrial enlargement : peaked p wave in lead II and III or V1 ≥ 0.25 mV in amplitude.
QRS complex	Frontal plane axis deviation : right ≥ + 120˚ or left -30˚ to 90˚ Increased voltage : amplitude of R or S wave in a standard lead ≥ 2mV.S wave in lead V1 or V2 ≥ 3mV, plus R wave in lead V5 or V6 ≥ 3mV. Abnormal Q wave : ≥ 0.04 sec in duration or 25% of the height of the ensuing R wave or QS pattern in two or more leads. Right or left bundle branch block with QRS duration ≥ 0.12sec. R wave in lead V1 ≥ 0.5 mV in amplitude and R:S ≥ 1.
ST segment , T wave and QT interval	ST segment depression or T wave flattening or inversion in two or more leads. Prolongation of heart rate corrected QT interval > 0.44 sec in males or 0.46 sec in females.
Rhythm and conduction abnormalities	Premature ventricular beats or more severe ventricular arrhythmias Supra ventricular tachycardias, atrial flutter or atrial fibrillation. Short PR interval (≤ 0.12sec) with or without delta waves Sinus bradycardia with a resting Heart rate ≤ 40 beat[a]. First (PR > 0.2 sec[a]), second or third degree atrio-ventricular block.

[a] Increasing less than 100 beats/min during limited exercise time.
[a] Not shortening with hyperventilation or limited time exercise.

Table 2: ECG features of cardiac abnormalities detectable in general population[17]

Disease	P wave	PR interval	QTc interval	QRS complex	ST interval	T wave	Arrhythmias
HCM	Left atrial enlargement	normal	normal	Increased voltage in the mid left precordial leads.abnormal Q waves in the inferior/lateral leads.LAD LBBB and delta waves	Down sloping ,up sloppng	Inverted T wave in mid left precordial leads	Afib,PVB, VT
ARVD	normal	normal	normal	Prolonged > 110 ms in the Rt precordial leads;reduced voltage ≤ 0.5 mV in the frontal leads;epsilon waves in the Rt precordial leads;RBBB	Up sloping in the Rt precordial leads	Inverted in the Rt precordial leads	PVB with a LBBB pattern,VT with a LBBB pattern.
Dilated cardiomyopathy	Left atrial enlargement	Prolonged ≥ 0.21 sec	normal	LBBB	Down sloping	Inverted in the inf/lateral leads	PVB;VT
Long QT syndrome	normal	Normal	>440ms in males and >460 in females	normal	normal	Bifid or biphasic in all leads	PVB ;torsades de pointes.
Brugrada syndrome	normal	Prolonged ≥ 0.21sec	normal	S1S2S3 pattern;RBBB/LAD	Up sloping coved type in the Rt precordial leads	Inverted in the Rt precordial leads	Polymorphic VT;Afib; Sinus bradycardia
Short QT syndrome	normal	Short < 300ms	normal	normal	normal	normal	2nd and 3rd degrees AV block.
Pre-excitation (WPW)	normal	Short < 0.12 sec	normal	Delta waves	2nd changes	2nd changes	SVT,Afib
Coronary artery disease	normal	prolong	normal	Abnormal Q waves	Down or up sloping	Inverted in > 2 leads	PVB;VT

. QT c; corrected QT interval for HR using bazzet's formula, LBBB : left bundle branch block, RBBB : right bundle branch block, LAD: left axis deviation, PVB : premature ventricular beats, VT : ventricular tachycardia.

RESULTS

A total of 1825 people were included in the study. People suffering from documented coronary artery disease, hypertension, diabetes mellitus, peripheral arterial disease totaling 307 were excluded from the study. The remaining 1518 people with no prior documented medical history of any serious medical or surgical illnesses, to the best of their knowledge, were included in the study. The mean age was 36.13 ± 12.38. Males were 81% and females included in the study were around 19%.

ECG abnormalities were noted in 74 (4.87 %) individuals, rest of the 1444 (95.12%) were reported normal in accordance with the prespecified criteria. Among females the ECG abnormalities were noted in 8 (2.88%) while in males these were found in 66 (5.48%). The ECG abnormalities along with their gender wise distribution are shown in the figure 1. Among females the most common ECG abnormalities were ST depression and T-wave changes. Among male

Figure 1: Gender Wise Distribution

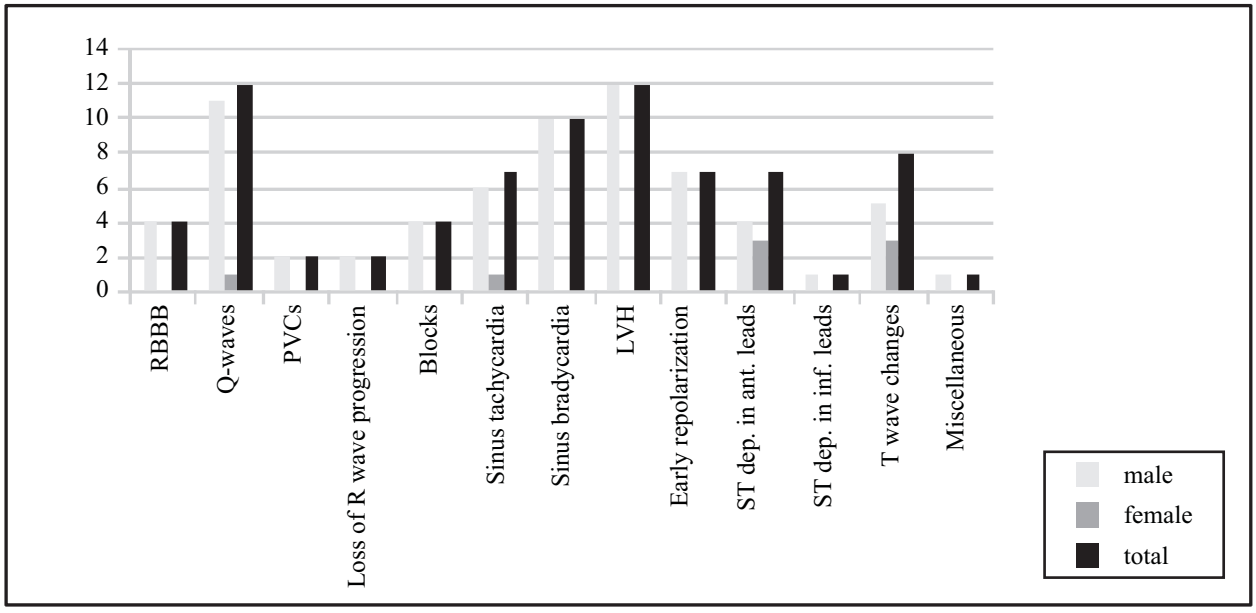
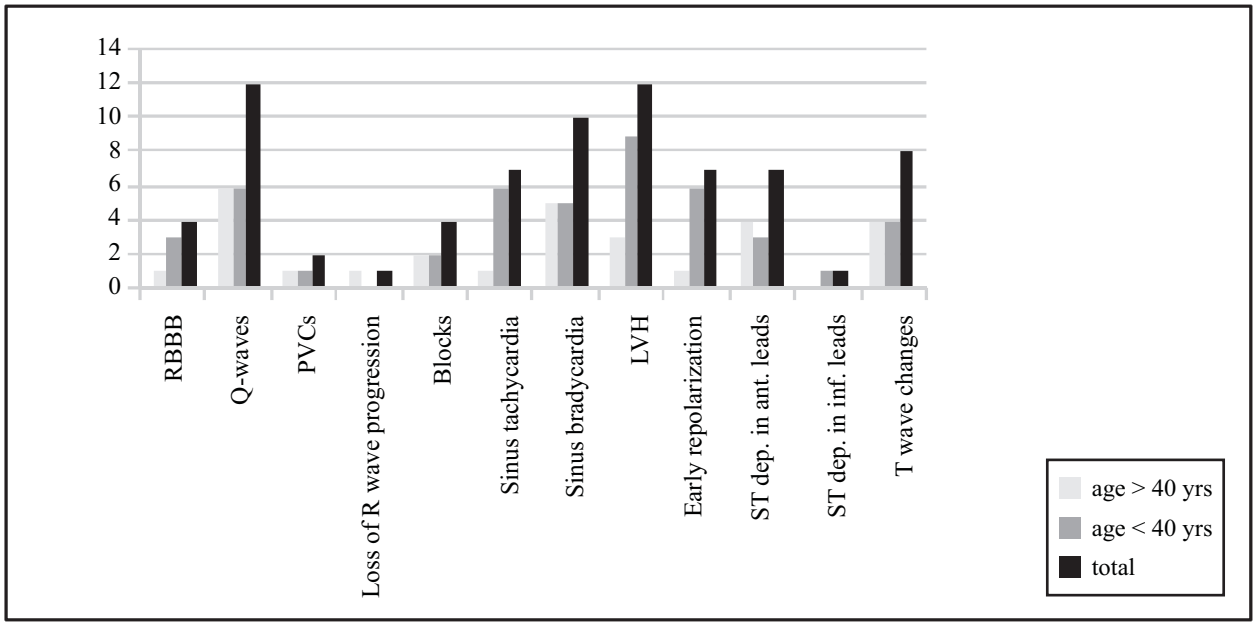


Figure 2: Age wise distribution



subjects LVH was the most commonly detected abnormality, followed by the detection of an old MI of which they had no recollection. Sinus bradycardia and tachycardia was also seen in a number of male subjects.

Total of 1444 study subjects were labeled as normal, among whom 891 (61.8 %) were less than 40 years of age and 550 (38.2%) were above 40 years of age. Age wise distribution of the rest of subjects who had some abnormality on ECG is shown in figure 2. ECG abnormalities which were more common in individuals above 40 years of age were loss of R wave, ST-depression in anterior leads. ECG abnormalities which were more common in individuals below 40 years of age were Right bundle branch block, sinus tachycardia, LVH, early repolarization, STdepression in inferior leads. ECG abnormalities which were found almost equally in both groups were Q waves, PVCs, blocks, sinus bradycardia, T wave changes.

DISCUSSION

The ECG has widely been described in medical reports as a useful diagnostic tool for assessing ″silent″ heart disease. Many epidemiological studies have shown the association between ECG findings and coronary and other cardiovascular diseases and mortality[3, 13].

Our study is different from many other epidemiological studies, in that it is population based, with participants from various socio economic backgrounds, professions and age groups. We also excluded patients with known coronary artery disease or documented risk factors for cardiovascular disease like diabetes, dyslipidemia or obesity. Moreover most studies carried out previously were only in men, while we also included women in a small but significant number. Most studies carried out were in a specific age group but we had no age restriction for inclusion though we did a post hoc analysis of subjects above and below 40. After thorough search we didn't come across any study which addressed the prevalence of ECG abnormalities in general population. Most of the studies conducted were searching for ECG changes to detect cardiac abnormalities leading to sudden cardiac death in younger population especially athletes.

In our population the prevalence of ECG abnormalities were 4.87% (n=74). The prevalence in males was 5.48% (66) while it was 2.88% (8) among female. This is in comparison to other epidemiological studies in Europe and US. In a study by de bacques et al[15] , in a large population of around 45000, the prevalence was around 6 % in men and 4.3% in female. In two US studies the 8charlesteston heart study[12] the prevalence of ECG abnormalities was around 7% in both men and women. In Chicago heart association detection project[6], ECG abnormalities were detected 9.6% and 12.9 % in men and women respectively. The prevalence in these studies was higher than our study which may be due to the fact that they haven't excluded documented coronary artery disease and other cardiovascular risk factor from their study. Secondly with the use of very strict coding system in these studies they have also included minor ECG changes in their study.

Q wave patterns, ST segment depression or elevation, T wave inversion or flattening, and left bundle branch block are often seen as indications of silent myocardial ischemia. The overall prevalence of ischemic ECG changes was 1.84% (n=28). In men it was 1.69% (n=21) and in women 2.52% (n=7). In European (Refrew and Pailey survey[14], Scottish heart health survey) and in some US studies (Framingham study[18-20], Chicago heart association project[6]), the prevalence is around 9 to 10%. This again is due to the fact that these studies didn't excluded coronary artery disease subjects from their population. In Hanolulu heart program[10] the prevalence was less than 5 % in general population yet again they didn't exclude patients with known CAD. The results of our trial and many US and European study did prove that the sensitivity of ECG when compared with other advanced cardiac tools for detection of CAD is very low and therefore it can't be used as a screening tool, yet it is cheaper and easily available modality and when it comes out to be normal has an excellent negative predictive value.

The definition for left ventricular hypertrophy in our study was the joint occurrence of High R waves and ST-T type abnormalities. Many criteria for an ECG definition of left ventricular hypertrophy have been suggested, most of which have high specificity but low sensitivity. In clinical practice and epidemiological research, tall R waves have often been associated with a diagnosis of left ventricular hypertrophy, though when accompanied by ST segment depression and T wave inversion this feature has been shown to be a more powerful risk factor for the development of coronary artery disease[21].

The prevalence of LVH was noted to be around 0.7 % in our study with virtually none of our female subjects having LVH, this is in comparison to international studies like that Framingham estimates that showed a prevalence of 0.9% and charesleston[12] study that showed a prevalence of 0.6%.

Similarly blocks were shown to occur in 0.2 % of our population, although limited data are available on the prevalence of blocks, results were comparable to Framingham[20] estimate that was around 0.3%.

CONCLUSION

ECG abnormalities are not uncommon in our normal population. ECG is an easily available and cost effective tool for screening cardiac abnormalities.

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