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Full Length Research Paper

Prevalence of non – infarcted ST segment elevation in asymptomatic Nigerian adults

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ABSTRACT

Acute myocardial infarction is a known cause of ST segment elevation. However, there are other causes of ST elevation other than acute myocardial infarction which may or may not be accompanied by chest pain. This study focuses on the prevalence of non – infarcted ST elevation in asymptomatic adult Nigerians and its relationship with high blood pressure, age, and gender. In a cross sectional community based study and by a stratified random sampling method, 229 subjects were selected for the study. Blood pressure was measured by standard protocol. A 12 lead resting electrocardiography was performed on all subjects. The prevalence of ST elevation in the subjects was 34.1%. All ST elevations were concave shaped and occurred in the praecordial leads with the highest frequency occurring in anterior leads V2- V4. There was no significant difference in the frequency of ST elevation in hypertensives and non hypertensives (χ^2 = 0.33, p = 0.569). ST elevation was not significantly related to gender (χ^2 = 2.362, p = 0.124); but was significantly related to young age ≤ 40years (χ^2 = 6.039, p = 0.014). These features suggest benign early repolarisation. Benign early repolarisation is the commonest cause of ST segment elevation in asymptomatic adult Nigerians. It is a non infarcted cause of ST elevation. It has no significant relationship with high blood pressure or gender but is significantly related to young age.

Keywords: Non - infarcted ST segment elevation, benign early repolarisation.

INTRODUCTION

The ST segment of the electrocardiogram (ECG) represents the period from the end of ventricular depolarization to the beginning of ventricular repolarization. It lies between the end of the QRS complex and the initial deflection of the T wave. It is normally isoelectric.

An ST segment elevation is considered significant if the vertical distance between the ECG trace and the isoelectric line at a point 0.04 seconds after the J- point is at least 0.1mv (usually representing 1mm) in a limb lead or 0.2mv (2mm) in a praecordial lead (Family Practice Notebook > ST Elevation (http://www.fpnotebook.com/cv/exam/StElvtn.htm)). The isoelectric line is either the PR segment or TP segment. ST elevation is measured at J- point if relative to TP segment (Chan et al., 2005).

Acute myocardial infarction (AMI) is a known cause of ST segment elevation (Otto and Aufderheide, 1994). However most ST segment elevation is a result of non-infarcted causes. These include acute pericarditis (Chan et al., 1999), benign early repolarization (Kambara and Phillips, 1976), left bundle branch block (Shhpak et al., 1999), Brugada syndrome (Brugada and Brugada, 1992), left ventricular aneurysm, hyperkalemia (Levine et al., 1956), hypothermia, pulmonary embolism (Sreeram et al., 1994), Prinzemetal angina (Prinzemetal et al., 1959), and post electrical cardioversion (Van Gelder et al., 1991).

Considering the rising prevalence of coronary artery disease in the developing world, it is important to remember that AMI is not the only cause of ST segment elevation. Of patients presenting with chest pain in one study 171 out of 202 patients (85%) (Brady, 1998) and 63 of 123 (51%) in another study had diagnoses other than AMI. The most common causes of ST segment elevation in this group of subjects were benign early repolarization, left bundle branch block, left ventricular hypertrophy and ventricular aneurysm (Jaynes et al., 1992).

The present study focuses on the prevalence of non – infarcted ST segment elevation in asymptomatic subjects with the aim of identifying the prevalence and patterns on the ECG that differentiate them from true infarction and other of ST elevation. Also in certain instances patients with other causes of ST elevation may be asymptomatic. There are often clues in the ECG to differentiate the ST segment of AMI from other causes. This would help to foster correct diagnosis if these subjects develop chest pain not due to AMI and prevent them being confused with AMI.

MATERIALS AND METHOD

There were 229 subjects in the study aged 18 – 78years. These were recruited by a stratified random sampling method of households from the Federal Capital Territory (FCT) Abuja Nigeria where the study was carried out between May 2009 and June 2010. Stratification was by age, gender and location. The study was cross sectional and community based.

Ethical approval was obtained from the department of Health, Abuja municipal area council and the ethical committee of the Benue State University Makurdi. Informed consent in written form or by a thumb print was obtained from the participants after due explanation before they were used for the study.

Data collection sheets were used to obtain the age, gender and relevant clinical history of the participants. Inclusion criteria were all participants of either sex aged between 18 – 80years who were asymptomatic without a history of chest pain. Exclusion criteria were participants with a history of chest pain or symptoms of underlying heart disease, pregnant women and diabetic patients. Based on above criteria, 229 subjects were eventually selected for the study.

Blood pressure was taken from the non – dominant arm after 5 minutes of rest using Accosson's mercury sphygmomanometer and appropriate cuff size. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were the first and fifth koroktoff sounds respectively. Hypertension was defined as SBP ≥140mmHg and/or DBP ≥ 90mmHg or being on drug therapy for hypertension.

A 12 lead resting electrocardiography was carried out on all selected participants using Cardiofax ECG – 9620 model machine. Electrodes were placed following the standard ECG configuration. Significant ST segment elevation was defined as ST segment elevation ≥1mm in praecordial leads and/or ≥ 1mm in limb leads in two or more consecutive leads meeting the criteria for thrombolytic therapy according to the guidelines of the American College of Cardiology (ACC)/ American Heart Association (AHA) (Ryan et al., 1996).

Data analysis was carried out using SPSS version 20 statistical soft ware. Pearson Chi-Square test was used to analyse the relationship between ST segment elevation and high blood pressure, age and gender. Values of $p < 0.05$ were considered statistically significant.

RESULTS

Prevalence and characteristics of ST segment elevation

There were 229 subjects aged between 18 – 78years. 113 were males and 116 were females. Also 118 participants were aged ≤ 40years and 111 participants were aged > 40years. The prevalence ST segment elevation in the study population was 34.1% occurring in 78 subjects out of the 229. The frequency in the various praecordial leads is as shown in figure 1. The highest frequency occurred in anterior leads V2 –V4 (20.1%). No ST segment elevation was recorded in limb leads. The ST elevations were of concave morphology measuring 1mm – 2mm in amplitude without associated PR segment depression.

Relationship with blood pressure

There were 52 hypertensives in the study. Out of these, 16 of them (30.1%) had ST segment elevation while 36 (69.2%) had no ST elevation. There were 177 non hypertensives out of which 62 (35.0%) had ST elevation while 115 (65.0%) had no ST segment elevation. There was no significant difference in the frequency of ST elevation between the hypertensives and non hypertensives.(χ^2 =0.325, p = 0.569). This is shown in table 2.

Relationship with age

There were 118 participants in the younger age group of 18 – 40years and there were 111 participants in the older age group of 41 – 78 years. In the young age group 41.5% had ST segment elevation while in the older age group 26.1% had ST segment elevation. This difference was statistically significant (χ^2 = 6.039, p = 0.014). Hence there is significant relationship between this type of ST segment elevation and young age. This is shown in table 1.

Relationship with gender

There were 113 males and 116 females. The prevalence of ST elevation was 38.9% in males and 29.3% in females. However this difference was not statistically significant (χ^2 = 2.362, p = 0.124). It is worthy to note

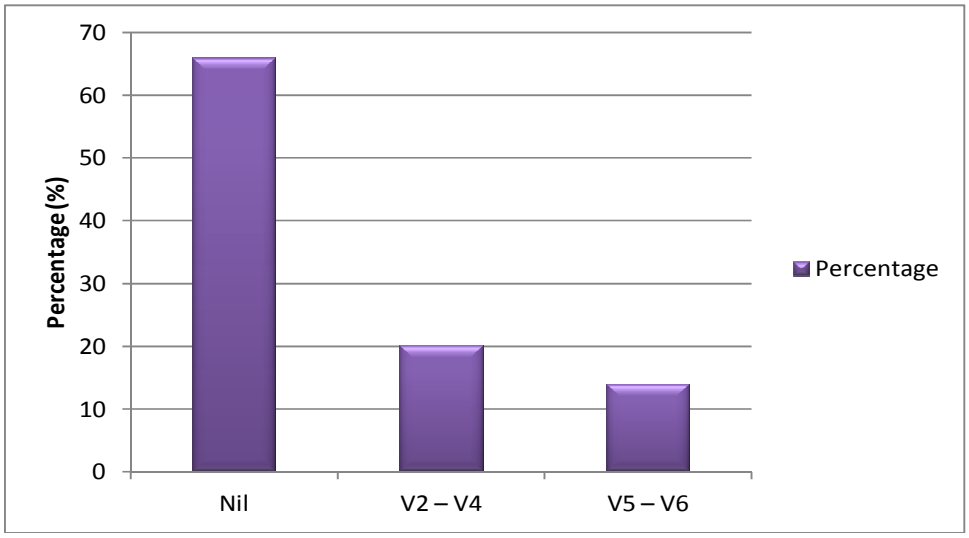

Figure 1. Prevalence of ST segment elevation in the praecordial leads

Table 1. Prevalence of ST segment elevation in the Praecordial leads

Praecordial lead	Frequency	Percentage (%)
Nil	151	65.9
V2 – V4	46	20.1
V5 – V6	32	14.0
Total	**229**	**100**

Table 2. Relationship between ST elevation and high blood pressure, age and gender

Variable	Total (%)	ST elevation(%)	No ST elevation(%)	Chi square(χ^2)	p-value
Hypertensive	52(22.7)	16(30.8)	36(69.2)	0.325	0.569
Non hypertensive	177(77.3)	62(35.0)	115(65.0)		
Age ≤40years	118(51.5)	49(41.5)	69(58.5)	6.039	0.014*
Age >40years	111(48.5)	29(26.1)	82(73.9)		
Male	113(49.3)	44(38.9)	69(61.1)	2.362	0.124
Female	116(50.7)	34(29.3)	82(70.7)		

=statistically significant

however that the ST segment elevation was commoner in males than females. This is shown in table 1.

DISCUSSION

Acute myocardial infarction resulting from an occlusive thrombus is recognized on an ECG by ST segment elevation (De Wood et al., 1980). These days when thrombolytic treatment and percutaneous interventions are carried out so readily, it is important to remember that AMI is not the only cause of ST segment elevation.

The present study has demonstrated that the overall prevalence of ST segment elevation in the asymptomatic subjects was 34.1% with the highest frequency occurring in the anterior leads V2 –V4 which was 20.1%. The ST elevation morphology was concave shape measuring 1mm – 2mm in amplitude without associated PR segment depression.

The cause of these ST elevations is thought to be due to benign early repolarisation (BER). This is due to the ECG characteristics of BER which usually gives an ST elevation < 2mm with concavity of the initial portion of the ST segment. There is also usually a concordant T wave inversion of large amplitude (Spodick, 1976). AMI demonstrates a convex and territorially distributed ST elevation while non-AMI causes demonstrate a concave shape elevation which may be diffuse.

With regards to high blood pressure ST elevation occurred in 30.5 % of hypertensives and 35.0% of non hypertensives. This difference was not statistically significant (χ^2 = 0.325, p= 0.569). Hence BER is not associated with high blood pressure. This further emphasizes the benign nature of the ST segment elevation.

Other causes of ST elevation like pericarditis, pulmonary embolism and Prinzemetal angina are accompanied by characteristic chest pain and/or breathlessness. In pericarditis ST segment is elevated diffusely in the praecordial leads as well as in the limb leads and in addition the PR segment is depressed (Spodick, 1976). In pulmonary embolism ST segment elevation occurs in both anteroseptal and inferior leads. There may be accompanying $S_1Q_3T_3$ pattern, complete or incomplete right bundle branch block and sinus tachycardia (Ferrari et al., 1997; Rodger et al., 2000).

The ST segment elevation in Prinzmetal angina and AMI are indistinguishable since they reflect the same pathophysiological process which is transmural ischemia/infarction from occlusion of an epicardial artery by transient spasm in the first condition and by persistent thrombus in the second condition. If the spasm lasts long enough infarction results (Oliva et al., 1973; Maseri et al., 1978).

Our study showed that ST segment elevation occurred more in the younger age group (41.5%) than in the older age group (26.1%) and this difference was statistically significant. Thus there is a relationship between BER and young age. It tends to occur in younger persons. This agrees with the findings of a study of normal electrocardiograms from 529 men. The prevalence of ST elevation of at least 1mm in one or more of leads V1 – V4 was 93% in men aged 17 – 24 years old[24]. The prevalence declined gradually with increasing age reaching 30% in men who were 76 years of age or older.

ST segment elevation occurred more in male subjects (38.9%) than in female subjects(29.3%). This difference was not statistically significant ($\chi 2$ = 2.362, p=0.124). Note however that it occurred more in males as is characteristic of BER. The study of Surawicz and Parikh, 2002 above showed that 20% of normal electrocardiograms from women had ST segment elevation of 1mm or more (compared to 93% stated above in men) and the prevalence remained unchanged regardless of the women's ages.

CONCLUSION

Benign early repolarisation is the commonest cause of ST segment elevation in asymptomatic individuals. It is a concave shaped ST elevation usually seen in the praecordial leads measuring 1mm – 2mm in amplitude. It has no relationship with high blood pressure and is commoner in young adult males.

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