

Prevalence of Early Repolarization Patterns in Adults

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ABSTRACT

Background

The finding of persistent Junction point elevation of 1 mm or more in adjacent leads in electrocardiogram is considered to be due to early repolarization. This condition was considered benign in the past but presently it is believed to be the rare cause of idiopathic ventricular fibrillation and sudden death.

Objective

The main objective of the study is to find out the prevalence of early repolarization pattern in subjects having electrocardiogram at Kathmandu Medical College Teaching Hospital.

Method

Twelve lead electrocardiograms of patients attending Kathmandu Medical College Teaching Hospital were studied. Data was collected for patient particulars. Electrocardiograms were analyzed for the type of early repolarization.

Result

The overall prevalence of early repolarization pattern of electrocardiogram was 2.82 %. It's prevalence in male and female was 4.95 % and 0.77 % respectively. The prevalence of different types of early repolarization electrocardiography pattern was 0.70 %, 1.25% and 0.63% of the population studied for type I, II, and III early repolarization patterns. Type IV or Brugada pattern was not detected in our study.

Conclusion

The commonest pattern observed was type II that is early repolarization pattern in inferior or inferolateral leads. Having knowledge of early repolarization and its type helps to counsel the physicians about the risk of arrhythmia and sudden cardiac death.

KEY WORDS

Electrocardiogram, prevalence, repolarization

INTRODUCTION

Electrocardiography (ECG) is one of the most commonly advised non-invasive investigations even at the present time. Early repolarization (ER) is a benign condition but some of its variants are associated with ventricular fibrillation and very rarely sudden death. People with ER of high risk and past history of cardiac arrest are recommended to have intracardiac defibrillator implantation. Most literatures define ER as being present on the ECG when there is Junction (J) point elevation of ≥ 0.1 mV in two adjacent leads with either a slurred or notched morphology.^{1,2} Loss of function mutation of the inward sodium channel gene have been implicated in patients with ER.^{3,4}

ER in the lateral leads (Type I) is found in healthy athletes and is considered benign. ER in the inferior or inferolateral leads (Type II) is associated with moderate risk. ER in the inferolateral and right precordial leads (Type III) is associated with high risk.⁵ J point elevation in the right precordial leads (Type IV) is known as Brugada pattern. J point elevation may not be present on repeat ECG in about 20% of patients after five years.⁶ People with ER pattern of electrocardiogram have no symptoms whereas those with ER syndrome have symptomatic arrhythmias.

Though ER is not a very common condition worldwide and is rarely associated with sudden cardiac death, it is advisable to find out its prevalence in our population so that the attending physician could be aware of its different types and counsel their patients in time.

The study aims to find out prevalence of ER and its types in our patients presenting to the hospital.

METHODS

This was a cross sectional observational study. The name, gender and age of all the persons undergoing ECG at Kathmandu Medical College Teaching Hospital in the outpatients were recorded from 1st August 2016 to 15th of September 2016. The details of personal particulars and the type of ER pattern ECG were also recorded. We calculated the sample size of 73 based on prevalence of 5% with estimated error of 5% and Z value of 1.96.⁶ All the ECG were scrutinized by one of the author. After segregating of ECG to one of ER pattern, the principal author classified to different group of ER pattern. In case of any dispute about the group, unanimous decision was taken by all the authors.

The study was approved by the institutional review board. Patients were enrolled after informed consent was obtained. We excluded the patients with bundle branch blocks, frequent ventricular premature complexes, or clinical diagnosis of acute myocardial ischemia. Patients with age of more than 18 years were included in the study. The ECGs with ER pattern were analyzed. IBM SPSS ver. 20 was used for statistical analysis.

RESULTS

The group of case subjects with ER pattern in the ECG included 31 men and five women with the mean age of 42.28 ± 19.20 years. The patients visited to the ECG lab without the evident ER patterns consisted of 626 men and 650 women with the total of 1276 in the specified duration of the study period.

Table 1. Age and gender distribution of ER patterns.

Age (yrs)	Male	Female	Total
18-24	8.64% (7/81)	0% (0/53)	5.22% (7/134)
25- 39	5.91% (11/186)	0.5% (1/193)	3.17% (12/379)
40- 59	3.11% (7/225)	0.77% (2/260)	1.86% (9/485)
≥ 60	4.48% (6/134)	1.39% (2/144)	2.88% (8/278)
Total	4.95% (31/626)	0.77% (5/650)	2.82% (36/1276)

The ER was seen most frequently in men between 18-24 years, as they are were likely to be physically active.

ER was more common in male with a male to female ratio of 6.2. At baseline, ER was present in lateral leads in 9 subjects, in inferior or inferolateral leads in 16 subjects, both inferolateral and anterior leads in eight subjects. Three patients had other patterns of ER. Brugada pattern of ER was not noted in our study. Notching was present in 6 subjects (16.7%). There was no PR depression in any of the subjects.

Table 2. Gender distribution of early repolarization ECG pattern type.

	Type I	Type II	Type III	Other	Total
Female	1	3	1	0	5
Male	8	13	7	3	31
Total	9	16	8	3	36

Type II ER was the commonest type in all age group. Table 3 shows the age distribution of different type of ER.

Table 3. Age distribution of Early Repolarization ECG pattern type

Age group	Type I	Type II	Type III	Other	Total
18- 24 yrs	1	5	1	0	7
25-39 yrs	3	3	3	3	12
40- 59 yrs	3	3	3	0	9
≥ 60 yrs	2	5	1	0	8
Total	9	16	8	3	36

Echo was done in 31 of the case subjects. Most cases had normal echocardiographic study. One subject had dilated LA, three cases had echocardiographic evidence of concentric LVH. Eight subjects have diastolic relaxation abnormalities in the mitral inflow Doppler study. Chest pain had been complained by 9(25%) of the people with ER but the repeat

ECG showed the similar ECG pattern. Diabetes mellitus was present in 8(22.2%) of subject whereas 10(27.8%) subjects were hypertensive. It was noted that 17(47.2%) of study subjects were smoker either current or past.



Figure 1. Type I and II ER patterns

DISCUSSION

Sudden cardiac arrest is a major public health condition that threatens life. Only 3-10% patients having out of hospital cardiac arrest survive despite rapid and efficient emergency medical system.⁷ Majority of such arrests is caused by ventricular arrhythmia. In 6-14% of such arrhythmia, there is no structural abnormality of heart.^{8,9} This is known as idiopathic ventricular fibrillation if there is also no preexisting QT prolongation or shortening.

About 1-13% of the population seem to have early repolarization ECG pattern.¹⁰⁻¹² It is generally considered to be benign. However, experimental studies have shown to be associated with its potential to cause ventricular arrhythmias.¹³

Hissaguerre et al. found prevalence of ER much more frequently in patients with idiopathic ventricular fibrillation than in control subjects (31 vs. 5%, $p < 0.001$).⁷ In the same study, defibrillation monitoring showed a higher incidence of recurrent ventricular fibrillation in case subjects with a repolarization pattern than in patient without such an abnormality (hazard ratio of 2.1 with confidence interval 1.2 to 3.5).⁷

The incidence of ER was 2.82% in our study. This is a hospital based study which was done in patients who came for ECG for various reasons. Several population based studies done in the West have found its prevalence as high as 13% although estimates have varied significantly between the studies. In a study of Finnish people enrolling 10,864 patients, ER was prevalent in 5.8%.⁶ In this study, 3.5% people had ER in inferior leads, 2.4% in lateral leads and in both in 0.1%. We also found highest incidence in inferior leads (1.25%) followed by lateral leads (0.71%) and in both in 0.63%. In another study involving 6213 patients of central Europe, the prevalence of ER was 13.3% (4.4% in anterolateral leads, 7.6% in inferior leads and 1% in both leads).¹⁴ So the proportion of ER is similar in different population, however, actual prevalence differs.

The perception that ER is a benign condition or literally a sign of good health changed over last two decades as evident from case reports, case control studies and population based studies that established the relationship between presence of ER and risk of ventricular arrhythmia and arrhythmic cardiac death.^{2,6,7,15} However, it should be noted that prevalence of ER is much higher than the incidence of idiopathic VT (about 10 per 100,000 population).¹⁶ It is now found that certain variables in the pattern of ER increases to the risk of arrhythmia.

The inferior location of ER as well as higher J point amplitude had higher risk of ventricular arrhythmia.⁶ Type III ER has highest risk of arrhythmia and sudden cardiac arrest. The horizontal or down sloping ST segment following ER portends a higher risk.¹⁷ The prognostic value of slurring and notching has not been clear in the risk estimation of ventricular arrhythmia.¹⁸ ER appears to be higher incidence in African Americans; however, there is no relationship of risk of arrhythmia and death with ethnicity.¹⁹ We had higher percentage of Brahmins caste in the incident ER pattern, though it is not a population based study.

Limitation

Being a hospital based study, true prevalence in the population cannot be found. But it will give insight into the situation. Long term follow up could not be done as it will give true risk over the extended period of time.

CONCLUSION

The overall prevalence of early repolarization in Nepalese population was 2.82% in this study. It was much more common in men and the age group 18-24 years, where incidence was 8.64%. This higher incidence suggests a common pattern in physically active people. However, types of early repolarization pattern, amplitudes of J point elevation, and patterns of ST segment following early repolarization are some important features that characterize the higher risk of arrhythmia. Having knowledge about different types of ER in our population and significance to arrhythmia risk will help clinicians to counsel patients having incidental early repolarization in their electrocardiography. Large population based study will be required to provide exact incidence and long term follow-up study will provide the incidence of arrhythmia.

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