The prevalence of early repolarization variant in Turkish male subjects: a clinical single center study

Türk erkeklerinde erken repolarizasyon prevalansı: Tek merkezli klinik çalışma

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ABSTRACT

Objectives: Early repolarization variant (ERV) detected in surface ECG has traditionally been considered a benign finding, but the presence of this pattern has recently been associated with vulnerability to ventricular fibrillation in many case reports and case-control studies. There is no information regarding the prevalence of ERV within the Turkish population. The aim of this study was to evaluate the prevalence of ERV within a sample group of the healthy Turkish male population.

Study design: We assessed the prevalence of ERV within a community-based general population of 504 healthy male subjects (mean age 37.3±10.7 years; range 18 to 55 years) using 12-lead electrocardiography. ERV was stratified by two independent cardiologists according to the J-point elevation (≥0.1 mV) in the inferior, lateral or both leads with QRS slurring or notching.

Results: The ERV pattern was present in 34 subjects (6.7%): 19 subjects (3.8%) displayed ERV in the lateral leads, 7 (1.4%) in the inferior leads, and 8 (1.6%) in both the lateral and inferior leads.

Conclusion: The prevalence of ERV within the healthy Turkish male population seems to be similar to the findings of previous population-based studies.

ÖZET

Amaç: Yüzey EKG'de saptanan erken repolarizasyon varyant (ER) bulgusu, yakın zamana kadar masum bir bulgu olarak kabul edilmiştir. Son zamanlarda bu bulgunun ventrikül fibrilasyonuna duyarlılığı artırdığına dair birçok olgu-kontrol çalışması ve olgu sunumu yayınlanmıştır. ER'nin Türk toplumundaki sıklığı hakkında herhangi bir bilgi bulunmamaktadır. Bu çalışmada, sağlıklı Türk erkek bireylerden oluşan bir örneklem üzerinde ER prevalansı araştırıldı.

Çalışma planı: On iki derivasyonlu yüzey EKG'si ile 504 sağlıklı erkek bireyin (ort. yaş 37.3±10.7; dağılım 18-55 yaş) ER prevalansı değerlendirildi. EKG'ler iki bağımsız kardiyolog tarafından inferiyor, lateral ve her iki bölgedeki derivasyonlada QRS çentiklenmesi ile birlikte J noktasının izoelektrik hattan ≥0.1 mV elevasyonu varlığı açısından değerlendirilerek kaydedildi.

Bulgular: Bireylerin 34'ünde ER saptandı (%6.7). ER bulgusu, olguların 19'unda (%3.8) lateral, 7'sinde (%1.4) inferiyor ve 8'inde (%1.6) inferiyor+lateral derivasyonlarda saptandı.

Sonuç: Türk erişkin erkek toplumda ER sıklığı, diğer beyaz toplumlarda yürütülmüş çalışmaların sonuçları ile uyumlu bulunmuştur.

The electrocardiogram (ECG) of early repolarization variant (ERV) is familiar to all cardiologists and has traditionally been considered a benign finding since first defined by Tomaszewski et al.[1] and Shipley et al.[2] ERV is characterized by prominent elevation of the junction (J-point) between the end of the QRS complex and the beginning of the ST segment that is upwardly concave on certain ECG leads.[1-4] Although ERV is usually considered a benign finding, its potential arrhythmogenicity has been suggested by recent clinical studies.[6,7] The presence of this pattern in leads other than V1 through V3, espe-

Abbreviations:

ERV *Early repolarization variant*
ECG *Electrocardiogram*

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cially in the inferior or lateral leads, with QRS notching or slurring (J wave) has recently been associated with vulnerability to ventricular fibrillation in many independent case-control studies.[8-10] The prevalence of ERV in the general population has been reported to vary from less than 1% to 13%, depending on age (predominant in young adults), race (highest among black populations), sex (predominant in males), and the criterion for J-point elevation (0.05 mV vs. 0.1 mV).[11] In patients with documented idiopathic VF and a structurally normal heart, the prevalence of ERV has been reported to range between 31% and 60%.[8,9] Since the importance of ERV is becoming more and more evident and there is no published data about its prevalence in our population, we aimed to undertake a clinical study to determine the frequency of ERV.

MATERIALS AND METHODS

Healthy students and medical staff, as well as personnel at our institution, who volunteered to participate in the present study were enrolled between December 2009 and May 2010. They did not report any systemic complaints or history of cardiac or metabolic disorders. Subjects on any medication and/or with any abnormal finding on physical examination were excluded from the study. The study population consisted of healthy male volunteer subjects (n=504) aged between 18 and 55 years (37.3±10.7 years). Twelve-lead ECGs were obtained from all subjects in a supine position at a paper speed of 25 mm/sec and a calibration of 10 mm/mV. ECGs were obtained by the same investigator using the same ECG recorder (Nihon Kohden ECG-9020K, Japan). The study was approved by the local ethics committee, and written informed consent was obtained from all subjects. Baseline ECGs were simultaneously evaluated in random order by two experienced cardiologists for the presence of ERV. ERV was defined as an elevation of the QRS-ST junction (J-point) ≥1 mm (0.1 mV) above the baseline with either QRS slurring (a smooth transition from the QRS segment to the ST segment) or notching (a positive J deflection inscribed on the S wave) in the inferior leads (II, III, and aVF), the lateral leads (I, aVL, and V4 to V6), or both[3,12] (Fig. 1). The anterior precordial leads (V1 to V3) were excluded from the analysis to avoid the inclusion of patients with other significant diseases that affect cardiac repolarization, such as arrhythmogenic right ventricular dysplasia or Brugada syndrome. Electrocardiographic exclusion criteria included any kind of arrhythmias and complete right or left bundle branch block.

Statistical analysis

Continuous and categorical variables were presented as mean±SD and percentage in each ERV group, respectively. To minimize errors in the evaluation process, ECGs were assessed for inter-observer variability using "Cohen's Kappa Statistic". The Kappa value was 0.896 (95% confidence interval: 0.694-1; Kappa: 0.8-1 = almost perfect). There was also high statistical agreement between the observers [Agreement: 98% (standard error: 0.103)]. The statistical analyses were performed using the Statistical Package for Social Studies (SPSS version 16.0, USA). P values <0.05 were considered statistically significant.

RESULTS

ERV was present in 34 (6.7%) of 504 healthy male subjects. Among these subjects, ERV was detected in the lateral leads in 19 (3.8%), the inferior leads in 7 (1.4%), and both the inferior and lateral leads in 8 (1.6%) (Table 1). The mean age of subjects with ERV was not significantly different from the mean age of subjects without ERV (p=0.53). Typical ECG examples demonstrating ERV in the lateral, the inferior and both the lateral and the inferior ECG leads are displayed in Fig. 1.

DISCUSSION

The overall prevalence of J-point elevation ≥0.1 mV in the inferior, lateral or both leads was 6.7% in our study. This prevalence rate seems concordant with the rates reported in previous studies performed on general populations or young adults.[8,10,12,13] We

Table 1. Frequency rates and locations of early repolarization variant on ECGs

	n	%	Age* (Mean±SD)
ERV absent	470	93.3	37.4±10.8
ERV present	34	6.7	
Lateral	19	3.8	38±9.1
Inferior	7	1.4	32±9.7
Inferior + lateral	8	1.6	31.1±5.1
Total	504	100	37.3±10.7

ERV: Early repolarization variant; ECG: Electrocardiogram. *Mean age was not significantly different between groups (p=0.53).

investigated ERV prevalence among the male adult population because male sex has been reported to be strongly associated with ERV.[13] Data in the literature indicate that more than 75% of individuals with ERV are men, and male gender represents 75% of arrhythmic cases.[14] The reason for the gender predilection of ERV is not clear; however, the larger epicardial transient outflow current (Ito) density of men may be a contributing factor.[14]

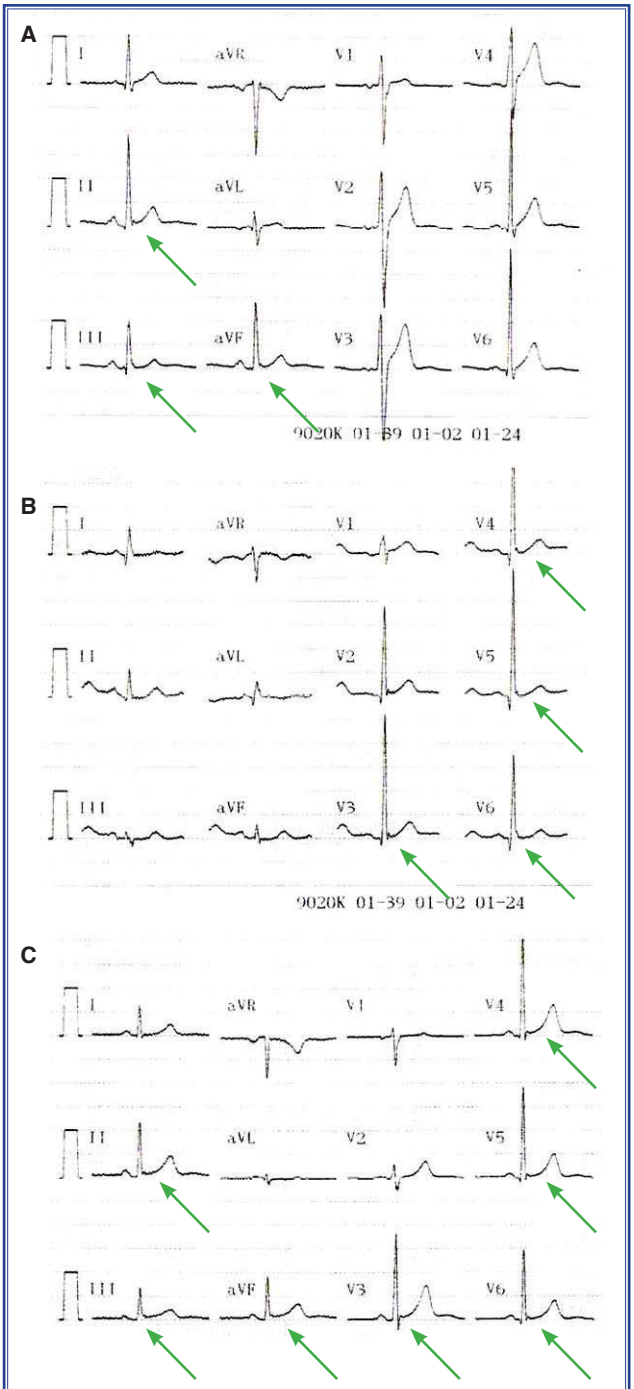

Figure 1. ECG samples of early repolarization variant (ERV). **(A)** ECG tracing of a 26-year-old healthy man with inferior ERV. **(B)** ECG of a 52-year-old healthy man with lateral ERV. **(C)** ECG of a 37-year-old healthy man with inferior and lateral ERV. J-point elevations and terminal QRS notchings in the related leads are visible and marked with arrows.

The presence of ERV on standard 12-lead ECG has generally been considered a benign finding in healthy individuals.[15,16] Contemporary data from some recent population-based studies have challenged this concept since J-point elevation in the inferior leads was considered a marker of increased risk of death from cardiac diseases among middle-aged subjects.[12] These data are consistent with recent reports of a higher incidence of ERV in leads other than V1 through V3 among subjects diagnosed with idiopathic ventricular fibrillation.[8,10] The pathophysiological mechanisms linking ERV with a tendency towards ventricular tachyarrhythmias have not been completely elucidated. However, experimental studies suggest that J-point elevation indicates increased transmural heterogeneity of ventricular repolarization which contributes to susceptibility to ventricular arrhythmias.[14] Autonomic tone may also play a major role and influence ERV-associated ventricular tachyarrhythmias since a substantial number of events were reported to occur more frequently during increased vagal tone, such as sleeping or after large meals.[8,17,18] Adrenergic stimulation such as exercise, however, has been shown to suppress ERV and associated arrhythmias.[19]

In a recent study by Tikkanen et al.,[12] the prevalence and prognostic significance of ERV within a community-based general population of 10,864 middle-aged subjects were assessed. Early repolarization pattern with J-point elevation of 0.1 mV or more was detected in 630 subjects (5.8%); 3.5% in the inferior leads, 2.4% in the lateral leads, and 0.1% in both the lateral and inferior leads. There was a strong male predominance in the subgroup with ERV pattern in the inferior leads and in the subgroup with ERV pattern in both the inferior and the lateral leads. J-point elevation of at least 0.1 mV in the inferior leads was associated with an increased risk of death from cardiac causes. J-point elevation of more than 0.2 mV in the inferior leads was associated with a markedly elevated risk of death from cardiac causes and from arrhythmia.

The frequency rate of ERV in our all-male study population was similar to the rate reported by Tik-

kanen et al.[12] However, ERV was more frequently observed in the lateral leads than in the inferior leads in our study compared to the study by Tikkanen et al. The underlying reason might be the small size of our study group and/or the inclusion of only male subjects. Kui et al.[13] investigated the prevalence of the J wave among healthy Chinese adults and reported a prevalence rate of 7.3%, a value similar to the one found in our study. However, as in the study of Tikkanen et al.,[12] J wave prevalence in the inferior leads was significantly higher than in the left and right precordial leads, an observation not consistent with our study.

The association of sudden cardiac death with ERV in recent studies kindled a new research area that should be further elucidated by larger and prospective studies. In a recent study on differentiating between benign and malignant ERV, the authors described a new finding implicating an association between a certain J wave morphology and a worse prognosis.[20] However, according to current data, it has not yet been determined how subjects with ERV should be followed and risk stratified. We therefore suggest that patients with ERV should be thoroughly evaluated and followed based on their family and personal history, as well as, their physical examination and symptoms.

In conclusion, despite its small size and single center based methodology, our study revealed that the prevalence of ERV within the healthy Turkish male population may be similar to the findings reported in previous studies of Caucasian male populations. Because of the suspected role of ERV in sudden arrhythmogenic death reported by recent clinical studies, the true frequency rate of ERV in the Turkish male population has to be determined. Since the present study is the first to report the frequency rate of ERV among male Turkish subjects, it should be regarded as an impetus for further larger community-based prospective studies.

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Key words: Diagnosis, differential; early repolarization variant; electrocardiography; heart; prevalence; risk factors.

Anahtar sözcükler: Tanı, ayırıcı; erken repolarizasyon varyantı; elektrokardiyografi; kalp; prevalans; risk faktörleri.