

## Tp-e interval and Tp-e/QTc ratio: new choices for risk stratification of arrhythmic events in patients with hypertrophic cardiomyopathy

To the Editor,

I read with a great interest the paper entitled "Tp-e interval and Tp-e/QTc ratio as novel surrogate markers for prediction of ventricular arrhythmic events in hypertrophic cardiomyopathy" by Akboğa et al. (1) published in *The Anatolian Journal of Cardiology*. In this novel investigation, the authors have shown that the Tp-e interval and Tp-e/QTc ratio were significantly longer and higher in patients with hypertrophic cardiomyopathy (HCM) than in controls. In addition, multivariate analysis revealed that these markers were associated with a higher risk of ventricular arrhythmic events (OR: 1.060; 95% CI: 1.005–1.117;  $p=0.012$  and OR: 1.148; 95% CI: 1.086–1.204;  $p=0.049$ , respectively).

The electrocardiogram is commonly used for predicting arrhythmogenic risk in clinical practice. Now, the Tp-e interval and Tp-e/QTc ratio have been proposed as markers for predicting malignant ventricular arrhythmias and have been evaluated and recommended as alternatives for risk stratification of sudden cardiac death in patients with several medical conditions.

The Tp-e interval is an index of the transmural dispersion of ventricular repolarization (VR); it reflects the different duration of the action potential in the epicardium, endocardium, and M cells from the heart. These cellular mechanisms are translated to the T wave on surface 12-lead electrocardiogram and allow the determination of an increase in the transmural dispersion of VR through a single measure from the peak or nadir to the end of the T wave. The Tp-e/QTc ratio includes values of the transmural and spatial dispersion of VR. Although it was initially thought that the Tp-e/QTc ratio remains relatively constant between a heart rate of 60 to 100 beats/min, many researchers have recently published good outcomes after the correction of this parameter by the heart rate (2, 3).

Patients with HCM have a predisposition for ventricular arrhythmias and sudden cardiac death. The structural abnormalities in HCM are diverse and generally associated with the severity and extension of the pathophysiological process. Disarray of cardiac fibers, microvascular ischemia, and fibrosis are conditions that predispose patients with HCM to an increase in the dispersion of VR, reentrant arrhythmias, and sudden cardiac death (4).

Current European guidelines propose an algorithm for the risk stratification of sudden cardiac death and suggest the insertion of an implantable cardioverter defibrillator in these patients based on several variables, including age, family history of sudden cardiac death, unexplained syncope, left ventricular outflow

gradient, maximum left ventricular wall thickness, left atrial diameter, and presence of non-sustained ventricular tachycardia during 24–48-h ambulatory electrocardiographic monitoring (5). However, no electrocardiographic marker is used on the basis of the analysis of VR, presumably because of a lack of evidence about its utility. The study by Akboğa et al. (1) may open a new field of investigation on this topic. The electrocardiogram is accessible by most patients. These markers may be obtained, analyzed, and interpreted easily by all physicians without any specific training. These features could represent an incentive to introduce these markers as part of future risk stratification models in patients with HCM. However, for this purpose, it is necessary to continue investigations in this field with prospective studies and with a larger number of patients.

**Yaniel Castro-Torres**

**Servicio de Cardiología, Hospital Universitario Celestino Hernández Robau, Santa Clara; Villa Clara-Cuba**

### References

1. Akboğa MK, Balcı KG, Yılmaz S, Aydın S, Yayla Ç, Ertem AG, et al. Tp-e interval and Tp-e/QTc ratio as novel surrogate markers for prediction of ventricular arrhythmic events in hypertrophic cardiomyopathy. *Anatol J Cardiol* 2017 Mar 9. Epub ahead of print.
2. Castro-Torres Y, Carmona-Puerta R, Katholi RE. Ventricular repolarization markers for predicting malignant arrhythmias in clinical practice. *World J Clin Cases* 2015; 3: 705-20.
3. Gupta P, Patel C, Patel H, Narayanaswamy S, Malhotra B, Green JT, et al. Tp-e/QT ratio as an index of arrhythmogenesis. *J Electrocardiol* 2008; 41: 567-74.
4. Marón BJ, Marón MS. Hypertrophic cardiomyopathy. *Lancet* 2013; 381: 242-55.
5. Elliott PM, Anastasakis A, Borger MA, Borggrefe M, Cecchi F, Charron P, et al. 2014 ESC Guidelines on diagnosis and management of hypertrophic cardiomyopathy. The Task Force for the Diagnosis and Management of Hypertrophic Cardiomyopathy of the European Society of Cardiology (ESC). *Eur Heart J* 2014; 35: 2733-79.

**Address for Correspondence:** Dr. Yaniel Castro-Torres

Luz Caballero 161 e/ Hospital y Alejandro Oms  
Reperto Parroquia, Santa Clara, Villa Clara-Cuba

E-mail: yanielct@infomed.sld.cu and castrotorresy@gmail.com

©Copyright 2017 by Turkish Society of Cardiology - Available online  
at [www.anatoljcardiol.com](http://www.anatoljcardiol.com)

DOI:10.14744/AnatolJCardiol.2017.7865



### Author's Reply

To the Editor,

I thank the journal readers for their interest in our original article entitled "Tp-e interval and Tp-e/QTc ratio as novel surrogate markers for prediction of ventricular arrhythmic events in hypertrophic cardiomyopathy" recently published in *The Ana-*

tolian Journal of Cardiology 2017 Mar 9. Epub ahead of print (1).

Hypertrophic cardiomyopathy (HCM), a common genetic heart disease characterized by ventricular hypertrophy, impaired ventricular relaxation, and myocardial fibrosis, is significantly associated with a higher risk of fatal ventricular arrhythmic events (2). HCM is a leading cause of sudden cardiac death (SCD) in young adults (3). Current 2014 European Society of Cardiology (ESC) guidelines on the diagnosis and management of HCM recommend a prophylactic implantable cardioverter defibrillator (ICD) therapy for the primary prevention of SCD in high-risk patients based on age, unexplained syncope, family history of SCD, maximum left ventricular wall thickness (LVWT), maximum left ventricular outflow (LVOT) gradient, left atrial size, and non-sustained ventricular tachycardia (NSVT) during 24–48-h Holter monitoring at or prior to evaluation (2, 3). Other than these variables, Kang et al. (4) have recently demonstrated that the presence of a fragmented QRS complex (fQRS) on 12-lead electrocardiography (ECG) is significantly associated with a higher risk of fatal ventricular arrhythmia events (VAEs), including NSVT, VT, and SCD in patients with HCM. Similarly, in our study we observed that prolonged Tp-e interval and increased Tp-e/QTc ratio are independent predictors of VAEs in patients with HCM (1). The Tp-e interval (the interval between the peak and end of the T wave on ECG) is described as an index of total dispersion of ventricular repolarization, and a longer Tp-e interval has been found to be related to arrhythmias and mortality (5). Although the Tp-e interval is affected by the heart rate and body surface area, the Tp-e/QTc ratio is represented as a more accurate index of VR (6). Recent studies have confirmed that these simple ECG parameters, including the Tp-e interval, Tp-e/QTc ratio, and fQRS, are very useful tools for predicting adverse cardiac events (4, 5). Therefore, I believe that these parameters will be used to a larger extent in clinical practice in the future.

In conclusion, if these findings are confirmed via further and larger prospective trials, these easily available ECG parameters such as the Tp-e interval, Tp-e/QTc ratio, and fQRS could be included in the HCM Risk-SCD Formula to more precisely assess the risk stratification in patients with HCM who are eligible for primary prophylactic ICD.

**Mehmet Kadri Akboğa**  
Department of Cardiology, Türkiye Yüksek İhtisas Training and Research Hospital; Ankara-Turkey

## References

1. Akboğa MK, Gülcihan Balcı K, Yılmaz S, Aydın S, Yayla Ç, Ertem AG, et al. Tp-e interval and Tp-e/QTc ratio as novel surrogate markers for prediction of ventricular arrhythmic events in hypertrophic cardiomyopathy. *Anatol J Cardiol* 2017 Mar 9. Epub ahead of print.
2. Elliott PM, Anastasakis A, Borger MA, Borggrefe M, Cecchi F, Charron P, et al. 2014 ESC Guidelines on diagnosis and management of hypertrophic cardiomyopathy: The Task Force for the Diagnosis and Management of Hypertrophic Cardiomyopathy of the European Society of Cardiology (ESC). *Eur Heart J* 2014; 35: 2733-79. [CrossRef]
3. O'Mahony C, Jichi F, Pavlou M, Monserrat L, Anastasakis A, Rapezzi C, et al; Hypertrophic Cardiomyopathy Outcomes Investigators. A novel clinical risk prediction model for sudden cardiac death in hypertrophic cardiomyopathy (HCM risk-SCD). *Eur Heart J* 2014; 35: 2010-20. [CrossRef]
4. Kang KW, Janardhan AH, Jung KT, Lee HS, Lee MH, Hwang HJ. Fragmented QRS as a candidate marker for high-risk assessment in hypertrophic cardiomyopathy. *Heart Rhythm* 2014; 11: 1433-40.
5. Erikssen G, Liestol K, Gullestad L, Haugaa KH, Bendz B, Amliè JP. The terminal part of the QT interval (T peak to T end): A predictor of mortality after acute myocardial infarction. *Ann Noninvasive Electrocardiol* 2012; 17: 85-94. [CrossRef]
6. Akboğa MK, Yüksel M, Balcı KG, Kaplan M, Cay S, Gökbulut V, et al. Tp-e interval, Tp-e/QTc ratio, and fragmented QRS are correlated with the severity of liver cirrhosis. *Ann Noninvasive Electrocardiol* 2017; 22: e12359. [CrossRef]

**Address for Correspondence:** Dr. Mehmet Kadri Akboğa  
Türkiye Yüksek İhtisas Eğitim ve Araştırma Hastanesi  
Kardiyoloji Bölümü, Ankara-Türkiye  
Phone: +90 312 3061134 E-mail: mkakboga@yahoo.com

## A 31-year-old patient without the use of warfarin and with an aortic mechanical valve

To the Editor,

Patients with metallic prosthetic heart valves have to use anticoagulants throughout their life because of avoiding prosthetic valve thrombosis. We report the case of a patient with a prosthetic aortic valve without any event to date despite not using warfarin for 31 years. A 53-year-old man who underwent aortic valve replacement (AVR) with a mechanical valve (Medtronic, Inc., Minneapolis, Minnesota) due to aortic valve disease 31 years ago was admitted to the cardiology department with complaints of chest pain and tiredness. In the examinations and anamneses, it was determined that the patient was followed up with acetylsalicylic acid and dipyridamole treatment without the administration of warfarin after the valve replacement. He underwent AVR in 1985 because of severe aortic stenosis. He was recommended warfarin, but he had no anticoagulation since then.

His blood pressure was 125/85 mm Hg; his heart rate was regular at 90 beats/min. The baseline international normalized ratio was 1.1. The findings of his liver, thyroid, and kidney function tests were normal. His medications at home included acetylsalicylic acid 300 mg once a day and dipyridamole 50 mg QD.

Transthoracic and transesophageal echocardiography revealed a non-functional metallic aortic valve with a gradient of 60/80 mm Hg. Fluoroscopy showed minimal motion of the aortic valve prosthesis.

The patient primarily underwent the operation. Cardiac arrest after cross-clamp was observed in the patient who entered