ECRONICON OPEN ACCESS

EC CARDIOLOGY
Editorial

Tpeak-Tend Interval/QT Ratio in Percutaneous Coronary Intervention

Osmar Antonio Centurión[1,2]*, Karina E Scavenius[1,2], Christian O Chavez[1] and Orlando R Sequeira[2]

[1]*Department of Health Sciences' Investigation, Sanatorio Metropolitano, Fernando de la Mora, Paraguay*

[2]*Cardiology Department, First Department of Internal Medicine, Clinic Hospital, Asunción National University, San Lorenzo, Paraguay*

***Corresponding Author**: Osmar Antonio Centurión, Professor of Medicine, Asuncion National University and Department of Health Sciences' Investigation, Sanatorio Metropolitano, Fernando de la Mora, Paraguay.

Received: May 17, 2020; **Published:** June 02, 2020

Coronary heart disease (CHD) is the leading cause of mortality and morbidity worldwide affecting nearly 16 million persons over 20 years of age in the USA [1-4]. Ventricular arrhythmias are the more predominant cause of sudden cardiac death (SCD) in patients with coronary heart disease [5-7]. Several electrocardiographic indices have been proposed for risk stratification and prognosis in patients with coronary heart disease [8-10]. It is well known the association of prolonged QT interval and malignant ventricular arrhythmias and SCD. A prolonged QT interval has been shown to be closely associated with increased risk for SCD in some congenital and acquired channelopathies. Therefore, several studies have used the prolongation of QT interval as an index for predicting fatal arrhythmia and SCD in different entities [11-13]. In addition, another electrocardiographic interval, the interval from the peak of the T wave to the end the T wave, that is, the Tpeak-Tend (Tp-Te) interval has been proposed to be utilized in the prediction of malignant ventricular arrhythmias and SCD in some ion channel diseases [14-16].

Basic studies have shed important knowledge and insight concerning the Tp-Te interval. Animal experiments in rabbits and dogs regarding left ventricular wedge models have demonstrated that the Tp-Te interval in an electrogram measured across the wedge correlates well with the transmural dispersion of cellular repolarization (TDR) [17-19]. There are certain factors that may influence these electrocardiographic intervals. As body weight increases, there is a linear increase in the QT interval which is followed by a parallel increase in the Tp-Te interval. Moreover, as heart rate increases, the Tp-Te interval decreases linearly. Despite these mentioned changes in Tp-Te interval and QT interval, the Tp-Te/QT ratio remains relatively constant [14-16].

In patients with congenital long QT syndrome or short QT syndrome, disproportionate prolongation of the Tp-Te interval relative to the QT interval play an important role in 2 ventricular arrhythmogenesis. Indeed, the Tp-e/QT ratio may serve as an accurate index for the dispersion of ventricular repolarization, independent of dynamic changes in heart rate. It has been suggested that the Tp-Te/QT ratio is a more accurate predictor of ventricular arrhythmias than the QT interval, corrected QT, or Tp-Te interval. Additionally, a high value of Tp-Te/QT ratio has been associated with arrhythmic events associated with many different entities [20,21].

There is interesting data on the influence of Tp-Te/QT ratio in patients with acute coronary syndrome. However, little is known about this index in patients undergoing primary percutaneous coronary intervention (PCI). In this context, Zhao X., et al. [22] evaluated the Tp-Te/QT ratio immediately before PCI in patients with acute myocardial infarction to determine both its short- and long-term prognostic value. These authors [22] investigated the utility of the Tpeak-Tend/QT ratio as a marker of prognosis in 338 patients with ST segment elevation acute myocardial infarction undergoing primary PCI. The Tpeak-Tend/QT ratio was correlated with both short- and long-term outcomes. The optimal cutoff value for outcome prediction was a Tpeak-Tend/QT ratio of 0.29. A total of 115 (34%) patients exhibited a Tpeak-Tend/QT ratio ≥ 0.29. These patients showed elevated rates of both in-hospital death (22% vs 2%; $P < 0.001$) and main adverse cardiac events (48% vs 15%; $P < 0.005$). After discharge, the Tpeak-Tend/QT ratios ≥ 0.29 remained an independent predictor of all-cause

mortality (36% vs 5%, P < 0.001) and cardiac death (32% vs 3%, P < 0.001). Therefore, the authors concluded that the Tpeak-Tend/QT ratio may serve as a prognostic predictor of adverse outcomes after successful primary PCI treatment in ST segment elevation acute myocardial infarction patients [22]. Prolonged values Tp-Te/QT ratios have been related with sudden cardiac death and major advanced cardiac events during the hospital stay, and also with death from any cause or cardiac death associated with second- or third-degree atrioventricular block during the follow-up period. The clinical utilization of the Tp-Te/QT ratio as an electrocardiographic index for assessing risk in patients undergoing PCI may concede further advancements in clinical assessment, outcomes and prognosis in patients with coronary heart disease undergoing PCI.

In another interesting research performed in patients undergoing PCI, Wang X., et al. [23] studied the relationship between ST segment resolution post-PCI and Tp-Te interval in 374 patients with the first ST segment elevation acute myocardial infarction undergoing PCI. These ECG parameters were measured in infarction-related and non-infarction-related ECG leads. They prospectively evaluated the ST-segment resolution defined as ≥ 50% reduction as the complete ST resolution group, and those patients with less than 50% as the incomplete ST resolution group. The authors measured the Tp-Te intervals and the Tp-Te/QT ratio and related to major advanced cardiovascular events. They observed that the corrected Tp-Te interval (P< 0.001) and, the Tp-Te/QT ratio (P < 0.001) were significantly increased by myocardial infarction and partially recovered post-PCI. Patients with incomplete ST resolution showed more increased corrected Tp-Te interval (P < 0.001) and Tp-Te/QT ratio (P < 0.001) than those patients in the complete ST resolution group post-PCI. In multivariate analysis and receiver operating characteristic curves analysis, the Tp-Te/QT ratio was an independent and strongest predictor for ST segment resolution. These ECG parameters showed prognostic value for major advanced cardiovascular events in Kaplan-Meier survival analysis. Increased corrected Tp-Te interval and Tp-Te/QT ratio post-PCI predicted less ST segment resolution. The latter ECG parameter was the strongest predictor for ST segment resolution. The extent of ST segment elevation could represent the transmural potential gradients of phase 2 reentry. Increased Tp-Te interval could facilitate early and delayed after-depolarization-induced triggered activity developing malignant ventricular arrhythmias [21,24-26].

In conclusion, the Tp-Te/QT ratio is an important index of ventricular repolarization that was shown to remain constant despite differences in body mass or dynamic changes in heart rate. It provided a valuable consistency allowing longitudinal comparison of patient data. It is considered to be a more sensitive index of ventricular arrhythmogenesis compared with the sole utilization of either the Tp-Te interval or QT intervals. The Tp-Te/QT ratio further provides an estimate of dispersion of repolarization relative to total duration of repolarization and may serve as a prognostic predictor of major adverse cardiovascular events after successful PCI in patients with coronary heart disease. Further larger studies are needed and should be performed to evaluate in detail the medical utility and clinical implication.

Bibliography

1. Chen G and Levy D. "Contributions of the Framingham Heart Study to the Epidemiology of Coronary Heart Disease". *JAMA Cardiology* 1.7 (2016): 825-830.

2. Reynolds K., *et al*. "Trends in Incidence of Hospitalized Acute Myocardial Infarction in the Cardiovascular Research Network (CVRN)". *The American Journal of Medicine* 130.3 (2017): 317-327.

3. Braunwald E., *et al*. "Rationale and Clinical evidence for the use of GP IIb/IIIa inhibitors in acute coronary syndromes". *European Heart Journal* 19 (1998): D22-D30.

4. Cannon CP and Greenberg BH. "Risk stratification and prognostic factors in the post-myocardial infarction patient". *The American Journal of Cardiology* 102 (2008): 13G-20G.

5. Huikuri HV., *et al*. "Prediction of fatal or near-fatal cardiac arrhythmia events in patients with depressed left ventricular function after an acute myocardial infarction". *European Heart Journal* 30 (2009): 689-698.

6. Kuriachan V and Exner DV. "Role of risk stratification after myocardial infarction". *Current Treatment Options in Cardiovascular Medicine* 11 (2009): 10-21.

7. Goldenberg I., *et al*. "Corrected QT variability in serial electrocardiograms in long QT syndrome: the importance of the maximum corrected QT for risk stratification". *Journal of the American College of Cardiology* 48 (2006): 1047-1052.

8. Tse G and Yan BP. "Traditional and novel electrocardiographic conduction and repolarization markers of sudden cardiac death". *Europace* 19 (2017): 712-721.

9. Gimeno-Blanes FJ., *et al*. "Sudden cardiac risk stratification with electrocardiographic indices: A review on computational processing, technology transfer, and scientific evidence". *Frontiers in Physiology* 7 (2016): 82.

10. Abdelghani SA., *et al*. "Surface electrocardiogram predictors of sudden cardiac arrest". *Ochsner Journal* 16 (2016): 280-289.

11. Dekker JM., *et al*. "Heart rate-corrected QT interval prolongation predicts risk of coronary heart disease in black and white middle-aged men and women: the ARIC study". *Journal of the American College of Cardiology* 43 (2004): 565-571.

12. Goldenberg I., *et al*. "Corrected QT variability in serial electrocardiograms in long QT syndrome: the importance of the maximum corrected QT for risk stratification". *Journal of the American College of Cardiology* 48 (2006): 1047-1052.

13. Jimenez-Candil J., *et al*. "Short and long-term prognostic value of the corrected QT interval in the non-ST-elevation acute coronary syndrome". *Journal of Electrocardiology* 40 (2007): 180-187.

14. Castro Hevia J., *et al*. "Tpeak-Tend and Tpeak-Tend dispersion as risk factors for ventricular tachycardia/ventricular fibrillation in patients with the Brugada syndrome". *Journal of the American College of Cardiology* 47 (2006): 1828-1834.

15. Kanters JK., *et al*. "Tpeak Tend interval in long QT syndrome". *Journal of Electrocardiology* 41 (2008): 603-608.

16. Kors JA., *et al*. "The meaning of the Tp-Te interval and its diagnostic value". *Journal of Electrocardiology* 41 (2008): 575-580.

17. Yan GX., *et al*. "Ventricular repolarization components on the electrocardiogram: cellular basis and clinical significance". *Journal of the American College of Cardiology* 42 (2003): 401-409.

18. Yan GX and Martin J. "Electrocardiographic T wave: a symbol of transmural dispersion of repolarization in the ventricles". *Journal of Cardiovascular Electrophysiology* 14 (2003): 639-640.

19. Antzelevitch C., *et al*. "Does Tpeak-Tend provide an index of transmural dispersion of repolarization?" *Heart Rhythm* 4 (2007): 1114-1116.

20. Gupta P., *et al*. "Tp-e/QT ratio as an index of arrhythmogenesis". *Journal of Electrocardiology* 41 (2008): 567-574.

21. Shu J., *et al*. "Tp-e/QT ratio as a predictive index of sudden cardiac death in patients with ST-segment elevation myocardial infarction". *Journal of Xi'an Jiaotong University Medical Sciences 31* (2010): 441-443.

22. Zhao X., *et al*. "Association Between Tp-e/QT Ratio and Prognosis in Patients Undergoing Primary Percutaneous Coronary Intervention for ST-Segment Elevation Myocardial Infarction". *Clinical Cardiology* 35.9 (2012): 559-564.

23. Wang X., *et al*. "Tpeak-Tend/QT interval predicts ST-segment resolution and major adverse cardiac events in acute ST-segment elevation myocardial infarction patients undergoing percutaneous coronary intervention". *Medicine* 97 (2018): e12943.

24. Yan GX., *et al*. "Phase 2 reentry as a trigger to initiate ventricular fibrillation during early acute myocardial ischemia". *Circulation* 110 (2004): 1036-1041.

25. Arvenpää J., *et al*. "Changing capacity of electrocardiographic ventricular repolarization in postmyocardial infarction patients with and without nonfatal cardiac arrest". *The American Journal of Cardiology* 99 (2007): 295-299.

26. Hetland M., *et al*. "A novel ECG-index for prediction of ventricular arrhythmias in patients after myocardial infarction". *Annals of Noninvasive Electrocardiology* 19 (2014): 330-337.

Volume 7 Issue 7 July 2020