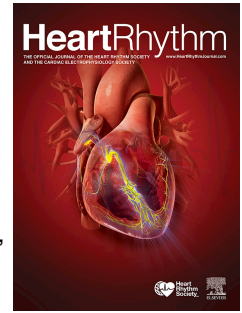


# Accepted Manuscript



Our doubts about the usefulness of the Tpeak-Tend interval

Heikki V. Huikuri, MD, Richard L. Verrier, PhD, FHRS, Marek Malik, PhD, MD, FHRS, Federico Lombardi, MD, Georg Schmidt, MD, Markus Zabel, MD

PII: S1547-5271(19)30035-9

DOI: <https://doi.org/10.1016/j.hrthm.2019.01.022>

Reference: HRTHM 7887

To appear in: *Heart Rhythm*

Received Date: 14 January 2019

Please cite this article as: Huikuri HV, Verrier RL, Malik M, Lombardi F, Schmidt G, Zabel M, Our doubts about the usefulness of the Tpeak-Tend interval, *Heart Rhythm* (2019), doi: <https://doi.org/10.1016/j.hrthm.2019.01.022>.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## Our doubts about the usefulness of the Tpeak-Tend interval

Heikki V Huikuri, MD<sup>1</sup>, Richard L Verrier, PhD, FHRS<sup>2</sup>, Marek Malik, PhD, MD, FHRS<sup>3</sup>,  
Federico Lombardi, MD<sup>4</sup>, Georg Schmidt, MD<sup>5</sup>, Markus Zabel, MD<sup>6</sup>

1 University of Oulu and University Hospital, Oulu, Finland,

2 Beth Israel Deaconess Medical Center and Harvard Medical School,  
Boston, MA, USA

3 Imperial College, London, England,

4 University of Milan, Milan, Italy,

5 Technische Universität München, Munich, Germany,

6 University of Göttingen Medical Center, Göttingen, Germany

*Correspondence:*

Marek Malik, PhD, MD,  
NHLI, Imperial College, London, England,  
marek.malik@imperial.ac.uk

## Our doubts about the usefulness of the Tpeak-Tend interval

We read with keen interest the counterpoint by Antzelevitch and DiDiego (1) in response to our point of view statement (2). First and foremost, we acknowledge the seminal nature of their work and its impact in stimulating experimental and clinical research.

Notwithstanding their impressive contributions to the field, we respectfully maintain that there are aspects of the Tpeak-Tend interval approach that merit further consideration. While the wedge preparation has provided important insights into basic cardiac electrophysiology and antiarrhythmic drug action, there remains controversy regarding the putative role of M cells in vivo. The absence of definitive resolution of this conundrum needs to be considered in evaluating the basis of Tpeak-Tend-based arrhythmia prediction.

As previously discussed [3], the Tpe cut-off reported by Tse et al cannot be taken without criticism. Their meta-analysis [4] made no distinction between different measurements (including studies that Antzelevitch and DiDiego criticise) and combined both heart rate corrected and uncorrected Tpe values. Beyond the electrophysiologic concept of Tpeak-Tend, there are practical issues that should be contemplated when using this parameter clinically. These include challenges of precise measurement, the selection measurement lead(s), and appropriate heart rate corrections. These issues apply equally to other interval-based arrhythmia risk markers. Finally, in the presence of a wide-spread publication bias towards positive findings, multiplicity of articles showing value of ECG measurements unfortunately means little if anything if the physiologic basis and practical issues in the measurement of this interval are insufficiently established. Overall, our main point is that while Tpeak-Tend has deservedly generated considerable interest in the field of arrhythmia risk assessment based on repolarization heterogeneity, theoretical and practical factors need to be recognized, whenever this measurement is employed.

Hence, our doubts remain serious about assessing repolarization heterogeneity accurately by simple interval measurements of standard ECG recordings.

Heikki V Huikuri,  
Richard L Verrier,  
Marek Malik,  
Federico Lombardi,  
Georg Schmidt,  
Markus Zabel

### References

- 1 Antzelevitch C, Di Diego JM. Tpeak-Tend Interval as a marker of arrhythmic risk. Heart Rhythm, in press.

- 2 Malik M, Huikuri HV, Lombardi F, Schmidt G, Verrier RL, Zabel M. Is the Tpeak-Tend interval as a measure of repolarization heterogeneity dead or just seriously wounded? *Heart Rhythm*, in press.
- 3 Malik M, Huikuri H, Lombardi F, Schmidt G, Zabel M. Conundrum of the Tpeak-Tend interval. *J Cardiovasc Electrophysiol* 2018; 29:767-70.
- 4 Tse G, Gong M, Wong WT, et al. The Tpeak-Tend interval as an electrocardiographic risk marker of arrhythmic and mortality outcomes: A systematic review and meta-analysis. *Heart Rhythm* 2017; 14:1131-7.