Relationship between T-wave alternans magnitude and T-wave amplitude before the onset of ventricular tachyarrhythmias during emergent reperfusion in acute coronary syndrome patients

We greatly appreciate Dr Madias’ remarks on our recent study demonstrating the usefulness of continuous T-wave alternans (TWA) monitoring in ultra-short-term prediction of impending life-threatening ventricular tachyarrhythmias (VTA) during emergent reperfusion therapy in acute coronary syndrome (ACS) patients.1 He raised an interesting question, namely, was there a relationship between the increase in TWA and the possible increase in T-wave amplitude prior to the occurrence of VTA?2 This question is based on his theory that TWA magnitude is affected by T-wave amplitude and should therefore be corrected.3

We evaluated the relationship between TWA magnitude and the corresponding T-wave amplitude (absolute value), both of which were reported for each 15 s of data in modified V1 and V5 leads in the three ACS patients with VTA. Data with noise levels >20 μV or obtained during atrial fibrillation, high-grade atrioventricular block, or paced rhythm were excluded from the analysis. Pearson’s correlation was applied to the regression analysis. The data were considered statistically significant when the two-tailed P value was <0.05.

There was no significant positive correlation between TWA magnitude and the corresponding T-wave amplitude in either modified V1 or V5 leads in the two patients.

Figure 1 Relationship between T-wave alternans magnitude and the corresponding T-wave amplitude in modified V1 and V5 leads in the three patients with ventricular tachyarrhythmias. (A) Patient with non-ST-segment elevation myocardial infarction and sustained ventricular tachycardia. (B) Patient with ST-segment elevation myocardial infarction and ventricular fibrillation. (C) Patient with unstable angina and ventricular fibrillation. There was no significant positive correlation between T-wave alternans magnitude and the corresponding T-wave amplitude. A weak negative correlation was found in modified V5 lead in patient (A). TWA, T-wave alternans; NS, not significant.
with ventricular fibrillation or in the patient with sustained ventricular tachycardia (VT). There was a weak negative correlation in modified V5 lead in the patient with VT (figure 1). These results indicate that the upsurge in TWA before the onset of VT was not merely a consequence of increased T-wave amplitude but provided a measure of the degree of cardiac electrical instability provoked by myocardial ischaemia-reperfusion.

We agree that TWA monitoring deserves further evaluation as an independent risk predictor of VTA in ACS patients.

Conflict of interest: R.L.V. is an inventor of the Modified Moving Average method for T-wave alternans analysis with patent assigned to Beth Israel Deaconess Medical Center and licensed by GE Healthcare Inc. and Medtronic Inc.

References

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Relationship between T-wave alternans magnitude and T-wave amplitude before onset of ventricular tachyarrhythmias during emergent reperfusion in acute coronary syndrome patients: a response

I would like to thank Dr Takasugi and his co-authors for their response to my inquiry regarding a possible relationship between T-wave alternans (TWA) magnitude (TWAM) and the corresponding T-wave amplitude prior to the emergence of ventricular tachyarrhythmias (VTA) in patients undergoing acute coronary interventions, reported in their recent article in the Journal.1 They did not find a ‘significant positive correlation between TWAM and the corresponding T-wave amplitude in either modified V1 or V5 leads’ in the three patients with VTA, and certainly these results indicate that the upsurge in TWA before the onset of VTA was not merely a consequence of increased T-wave amplitude but provided a measure of the degree of cardiac electrical instability provoked by myocardial ischaemia-reperfusion.2 Therefore, it was not feasible to explore further. Furthermore, the measurements carried out in the authors’ analysis pertained to the peak T-wave amplitude, whereas TWA refers to alternation of the electrocardiogram (ECG) ST-segment, T-wave, and U-wave.2 Indeed the authors, describing their TWA methodology of modified moving average, specifically stated that ‘T-wave alternans is computed as the maximum difference in amplitude between the odd-beat and the even-beat average complexes from the J-point to the end of the T-wave’ and the corresponding peak of the T-wave. Perhaps what should be correlated is the TWAM with a metric, reflecting the voltage amplitude of the J-point to the end of the T-wave interval, like for example the area under the ECG curve from the J-point to the end of the T-wave interval, as suggested previously.3

In closing I should admit that I am responsible for being most of the time casual about the variables (i.e. TWAM and T-wave amplitude) which need to be correlated. Mea culpa!!!

Conflict of interest: none declared.

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Should T-wave alternans magnitude be corrected with T-wave amplitude in the ultra-short-term prediction of life-threatening cardiac arrhythmias?

We appreciate efforts by Dr Madias to develop T-wave alternans (TWA) index based on the theory that TWA magnitude is affected by T-wave amplitude and should, therefore, be corrected.1 He suggested that there may be limitations in correlating TWA magnitude data derived from the J-point to the end of the T-wave with the corresponding peak of the T-wave.2

We could not measure the area under the ECG curve from the J-point to the end of the T-wave interval using the current analysis device. Therefore, it was not feasible to determine the relationship between peak