Ambulatory ECG-Based T-Wave Alternans: Reply

We thank Dr Madias for his interest and comments on our study. He had several questions, including the cut-off value of T-wave alternans (TWA) measured by the modified moving average (MMA) method, and the effects of T-wave amplitude on TWA. The first question was whether the value of max TWA (≥65 μV) was actually reliable in predicting outcome in the study group. The second question was how effective was the adjustment for the corresponding T-wave amplitude from the influence of heart rate changes. The third question was whether the generated TWA, adjusting the values measured by a parameter reflecting heart rate and T-wave amplitude, could provide a better prognostic value than the cut-off value of ≥65 μV.

Because certain numbers of normal individuals showed a positive TWA based on the assumed cut-off value in our study, as well as in other reports, it is very critical to determine the limits of the normal value of TWA. Actually, as Dr Madias pointed out, the max TWA value in our study was higher than that in previous studies in both normal subjects and patients. We also note that the point quoted by Dr Madias was reasonable and important. We think that the technical problem related to TWA analysis using the MMA method with a MARS PC system (GE Healthcare Inc, Milwaukee, WI, USA) was due to automatic filtering and processing of noise and artifacts of the software. We performed manual editing by gross inspection of the Holter records if the data were not eligible because of noise or artifacts. We believe that it is necessary to improve the technical aspects of the filtering system for noise and artifacts when using the MMA method. Furthermore, large-scale surveys with increased study populations are mandatory to evaluate an accurate and reliable cut-off value of TWA by the MMA method for risk stratification.

Dr Madias reported that TWA might depend on the T-wave amplitude and that measurement of an index of TWA (TWAI) was useful for assessing TWA in the same individual rather than by comparing single TWA assessments of different individuals. We completely agree that individual measurements of TWAI for each patient can give a good predictable value for risk stratification.

Second, we did not evaluate the TWA in terms of duration, amplitude and magnitude as in the previous report. It is well known that TWA is heart rate dependent. We need to perform selected analysis of ECG tracings at comparable heart rates recorded during resting conditions. This issue, however, might have the limitation of decreasing the merit of analyzing TWA using 24-h Holter recording during the daily life of subjects.

Third, Nieminen et al reported that a cut-off point of 65 μV would optimally separate patients at high risk, with cases of referral for routine clinical exercise testing that later developed sudden cardiac death or survived aborted sudden death during a follow-up of 4 years. Sakaki et al demonstrated that time-domain TWA with a cut-off point of 65 μV could predict cardiac mortality in patients with left ventricular dysfunction of ischemic and non-ischemic etiologies. Therefore, we used a cut-off point of 65 μV. Those authors thought that analysis of MMA-based TWA using a cut-off point of 65 μV can be a useful tool for predicting old MI patients at high risk of arrhythmic events among relatively small numbers of patients. In our study, however, we did not evaluate TWAI and the TWA in terms of duration, amplitude and magnitude. In the future, as suggested, we would like to perform additional analysis with increased numbers of subjects. Again, we appreciate Dr Madias’s valuable comments on our article, which will be incorporated into our future study.

References