Sudden cardiac death (SCD) is mostly precipitated by fatal ventricular arrhythmias (VA) such as ventricular fibrillation or ventricular tachycardia. As prevention of SCD, the implantable cardioverter defibrillator (ICD) has been the most promising therapy for such patients. However, the ICD has not only benefits but also potential adverse complications. Therefore, an appropriate indication for ICD implantation is always necessary. In addition, it is also very important to select the appropriate patient in order to manage medical costs within the limited healthcare budget. For this purpose, there are several non-invasive risk stratification methods using cardiac electrical signals. To date, signal-averaged electrocardiography (SAE), heart rate variability, and T wave alternans (TWA) have been the standard methods. Although many studies of these modalities have been reported, it is often difficult to predict future risk of fatal VA. Making the decision to implant an ICD by results solely based on these methods is still controversial.

Recently, T wave amplitude variability (TAV) has been limitedly reported as useful for predicting ventricular tachyarrhythmias. Although, TWA requires a heart rate >110 beats/min during exercise and >128 sinus beats for performing the test, this method could be applied in the rest condition with a lower heart rate over a few sinus beats using ambulatory monitoring. In this issue of the Journal, Stojkovic et al present their modified calculation with the addition of oscillation of the T wave. They define it as T-Var and prospectively evaluated it.

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in 121 patients who had already been implanted with ICD for various underlying diseases. They hypothesized that T-Var would be elevated in patients at high risk of fast, potential VA leading to SCD. They recorded 3 time points: baseline, after 6 months and 1 year with device interrogation. Patients with fatal VA had a higher T-Var in the short-time ECG compared with those without. The authors emphasize that high T-Var and increases in T-Var predict fast VA independently of left ventricular function with a high sensitivity and specificity.

Actually, they clearly demonstrate the high-risk patients with T-Var; however, this study brings us to the important consideration regarding reproducibility of diagnostic result and the measurement value as diagnostic indices. Cardiac electrical signals often fluctuate according to various factors such as recording conditions, autonomic tone, body build and other factors. Therefore, it is very important to evaluate the reproducibility of a measurement value before applying it to the clinical situation. Needless to say, control measurements with normal subjects are very helpful for application in high-risk patients. Levitt et al. compared TAV between patients at high risk of SCD and healthy subjects. They measured TAV at baseline and 3 months later. TAV measurements showed reproducibility from baseline to 3 months in both populations. However, there was no difference in its absolute (diagnostic) value between the at risk of VT/VF or SCD patients and healthy subjects. They concluded that the role of TAV as a risk-stratifying tool remains inconclusive. With regard to this conflicting result, Stojkovic et al. point out that the poor differentiation might be a solely related to TAV calculation. T-Var is a refined analysis of TAV and could successfully predict high-risk patients. Nevertheless, we should recognize that T-Var showed no difference at the initial recording of the 3 different time points. If the reproducibility of T-Var is high, consistent results would be expected at any time point, and that would prove the high diagnostic accuracy of T-Var.

In addition, even if single cardiac electrical signal analysis could achieve a high sensitivity and specificity, different analyses using the same signals may often indicate inconsistent diagnostic results. We suggest that the discordant result was obtained despite analyzing the same signals in 2 different analyses (time domain and frequency domain) on SAE. The reliability of 1 method should always be warranted by its reproducibility and diagnostic accuracy (Figure). Therefore, interpretation of these diagnostic findings by current non-invasive methods should be done with caution. More refined analyzing methods that give consistent and reliable results for detecting the future risk of fatal VA are desired.

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