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Eiichi Watanabe, Yoshihiro Sobue

*Division of Cardiology, Department of Internal Medicine,
Fujita Health University Bantane Hospital, Nagoya, JAPAN*

Prognostic Significance of Beat-to-Beat T-Wave Amplitude Variability in Cardiovascular Diseases: A Narrative Review

Research Question

Does beat-to-beat T-wave amplitude variability (TAV) provide prognostic information across cardiovascular diseases?

Background

TAV reflects short-term fluctuations in ventricular repolarization, serving as a marker of electrical instability. Elevated TAV has been linked with ventricular arrhythmias and mortality, but its role is not standardized.

Purpose

This narrative review evaluates the prognostic significance of TAV across genetic, structural, and ischemic cardiovascular conditions.

Methods

Key peer-reviewed studies reporting outcomes related to TAV were synthesized, including investigations in long QT syndrome, Chagas disease, cardiac resynchronization therapy (CRT), Brugada syndrome, idiopathic ventricular arrhythmia, and acute coronary syndrome.

Results

In congenital long QT syndrome, higher TAV predicted arrhythmic vulnerability beyond QTc (Extramiana et al., 2010). In Chagas disease, TAV was independently associated with all-cause and arrhythmic mortality (Ribeiro et al., 2011). Following CRT, reductions in TAV paralleled clinical and electrical response, suggesting modifiability (Zizek et al., 2012). In Brugada syndrome, combining TAV with late potentials improved identification of high-risk patients (Yoshioka et al., 2013). Among patients with frequent ventricular ectopy or without structural heart disease, TAV stratified susceptibility to ventricular tachyarrhythmias (Sobue et al., 2011; Ichikawa et al., 2016). In the TWIST study, Holter-derived TAV carried prognostic value in patients with ventricular tachyarrhythmias complicating acute coronary syndrome (Makino et al., 2023).



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Conclusion

Across diverse populations, TAV consistently reflects repolarization instability and conveys prognostic value independent of conventional parameters. Its responsiveness to therapy and complementarity with substrate markers highlight its clinical potential. Standardization of methodology and prospective multicenter validation are needed to establish TAV as a practical tool in cardiovascular risk stratification.

Keywords: sudden death, arrhythmia, repolarization, electrocardiogram

Biography

Eiichi Watanabe, MD, PhD (b. 1961, Koriyama, Japan) is Professor of Cardiology at Fujita Health University Bantane Hospital, Aichi. He completed his MD at Yamagata University, residency at St. Luke's International Hospital, and PhD at Nagoya University, with postdoctoral training at Louisiana State University. His research focuses on digital cardiology, sudden death risk, and remote monitoring of cardiac devices. He has authored over 130 peer-reviewed articles and serves as a board member of the Japanese Heart Rhythm Society, among other professional societies.