Positive T Wave in aVR: Is it just a mirror reflection or real?

Dear Editor,

We read the article by İçen et al.[1] reporting the association of ischemic changes in the aVR lead and left ventricular (LV) thrombus in patients with acute anterior myocardial infarction with great interest. The authors indicated that ischemic changes, such as T wave polarity and an ST-segment deviation in the aVR lead, seemed to be predictors of LV thrombus or high-grade spontaneous echo contrast in anterior myocardial infarction patients. In recent years, abnormalities in the aVR lead have drawn particular attention. As a marker of repolarization abnormality, a positive T wave observed on the aVR has emerged as a predictor of mortality and arrhythmic events in the general population[2,3] and in several diseases, including acute coronary syndromes and cardiomyopathies.[4–6]

We want to mention an important point. Repolarization is impaired and delayed in damaged myocardial cells, leading to changes in the direction of the T-wave vector toward to the injured myocardial regions, which may be observed as a positive T wave in the aVR lead.[7] When accompanied by a positive T wave in the aVR lead, the injured anterior of the LV myocardium also yields T-wave inversions in the inferolateral leads.[8] In the sample electrocardiograms (ECGs) with ischemic changes, all of the patients had T-wave inversions in the inferolateral leads.[1] The positive T wave seen in the lead aVR may be a mirror image of negative T waves in inferolateral leads. An evaluation of the predictive effect of T-wave inversions in the inferolateral leads may strengthen the results and yield a more comprehensive perspective.

In addition, the presence of a fragmented QRS, not only a marker of cardiovascular mortality and arrhythmic events, but also of left systolic dysfunction and fibrosis, should be evaluated.[9–13] The evaluation of these ECG parameters and an ECG-based risk score would empower and upgrade the study results. Accurately categorizing patients who are at high risk for thromboembolic events is critical.

We thank the researchers for addressing the importance of the 12-lead and the orphan lead aVR in ST-elevated myocardial infarction (STEMI) patients and presenting a simple and valuable ECG parameter as a predictor of poor prognosis. More individualized therapy using this novel ECG parameter to identify those at risk for thrombosis may improve the prognosis in STEMI cases.

Elif Hande Özcan Çetin, M.D.,[1]
Mehmet Serkan Çetin, M.D.[2]

[1]Department of Cardiology, Ankara City Hospital, Ankara, Turkey

[2]Department of Cardiology, TOBB-ETÜ University Faculty of Medicine, Ankara, Turkey

e-mail: dr.elifhande@gmail.com

doi: 10.5543/tkda.2019.24539

Conflict of interest: None declared.

References

1. İçen YK, Dönmez Y, Demirtaş AO, Koca H, Ardıç ML, Koç AS, et al. Ischemic changes in lead aVR is associated with left ventricular thrombus or high-grade spontaneous echocontrast in patients with acute anterior myocardial infarction. Turk Kardiyol Dern Ars 2019;47:168–76. [CrossRef]
2. Anttila I, Nikus K, Nieminen T, Jula A, Salomaa V, Reunanen A, et al. Relation of positive T wave in lead aVR to risk of cardiovascular mortality. Am J Cardiol 2011;108:1735–40.
3. Badheka AO, Patel NJ, Grover PM, Shah N, Singh V, Deshmukh A, et al. ST-T wave abnormality in lead aVR and reclassification of cardiovascular risk (from the National Health and Nutrition Examination Survey-III). Am J Cardiol 2013;112:805–10. [CrossRef]
4. Separham A, Sohrabi B, Tajlil A, Pourafkari L, Sadeghi R, Ghaffari S, et al. Prognostic value of positive T wave in lead aVR in patients with non-ST segment myocardial infarction. Ann Noninvasive Electrocardiol 2018;23:e12554. [CrossRef]
5. Shinozaki K, Tamura A, Kadota J. Associations of positive T wave in lead aVR with hemodynamic, coronary, and left ventricular angiographic findings in anterior wall old myocardial infarction. J Cardiol 2011;57:160–4. [CrossRef]
6. Ekizler FA, Cay S, Kafes H, Ozeke O, Ozcan F, Topaloglu S, et al. The prognostic value of positive T wave in lead aVR: A novel marker of adverse cardiac outcomes in peripartum cardiomyopathy. Ann Noninvasive Electrocardiol 2019;24:e12631.
7. Wagner GS, Macfarlane P, Wellens H, Josephson M, Gorgels A, Mirvis DM, et al; American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; American College of Cardiology Foundation; Heart Rhythm Society. AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram: part VI: acute ischemia/infarction: a scientific statement from the American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; the American College of Cardiology Foundation; and the Heart Rhythm

Society. Endorsed by the International Society for Computerized Electrocardiology. J Am Coll Cardiol 2009;53:1003–11.
8. George A, Arumugham PS, Figueredo VM. aVR - the forgotten lead. Exp Clin Cardiol 2010;15:e36–44.
9. Das MK, Saha C, El Masry H, Peng J, Dandamudi G, Mahenthiran J, et al. Fragmented QRS on a 12-lead ECG: a predictor of mortality and cardiac events in patients with coronary artery disease. Heart Rhythm 2007;4:1385–92. [CrossRef]
10. Das MK, Maskoun W, Shen C, Michael MA, Suradi H, Desai M, et al. Fragmented QRS on twelve-lead electrocardiogram predicts arrhythmic events in patients with ischemic and nonischemic cardiomyopathy. Heart Rhythm 2010;7:74–80. [CrossRef]
11. Pietrasik G, Goldenberg I, Zdzienicka J, Moss AJ, Zareba W. Prognostic significance of fragmented QRS complex for predicting the risk of recurrent cardiac events in patients with Q-wave myocardial infarction. Am J Cardiol 2007;100:583–6.
12. Ratheendran AC, Subramanian M, Bhanu DK, Prabhu MA, Kannan R, Natarajan KU, et al. Fragmented QRS on electrocardiography as a predictor of myocardial scar in patients with hypertrophic cardiomyopathy. Acta Cardiol 2019:1–5. [CrossRef]
13. Bayramoğlu A, Taşolar H, Bektaş O, Kaya A, Günaydın ZY. Association between fragmented QRS complexes and left ventricular dysfunction in healthy smokers. Echocardiography 2019;36:292–6. [CrossRef]

Authors reply

Dear Editor,

We would like to thank our colleagues who read our study[1] with such attention. The axis of the lead aVR is opposed to the left ventricular (LV) apical region, which provides unique information about global ischemia of this region.[2] In our study, T-wave positivity at the lead aVR was shown to be closely related to LV thrombus formation after acute anterior myocardial infarction.[1] Although Cetin et al. proposed that T-wave positivity in the lead aVR might reflect the presence of T-wave negativity at the inferolateral leads, only 1 patient in our study (Fig. 1b) demonstrated T-wave negativity at the inferolateral leads, which was found coincidentally. Consistent with previous studies,[3,4] we also reported that the lead aVR might provide indirect information about reciprocal ischemic changes in the LV apical region. However, no association between T-wave positivity at the lead aVR and T-wave negativity at the inferolateral leads as a reciprocal change was found in our study. In addition, fragmented QRS (fQRS) on a surface electrocardiogram (ECG) reflects delayed ventricular depolarization time, most likely due to ventricular myocardial scarring, and has been shown to be a marker of adverse cardiovascular outcomes in several cardiovascular diseases.[5,6] Although there are studies showing a significant association between fQRS and reperfusion failure and adverse in-hospital and long-term outcomes,[7] none of our patients demonstrated a fQRS on the 48-hour ECG, though this might be due to ECG assessment without magnification. Long-term follow-up data is lacking in our study because of the cross-sectional design; fQRS might develop over time due to LV scarring and remodeling.

Yahya Kemal İçen, M.D., Abdullah Orhan Demirtaş, M.D., Hasan Koca, M.D., Mevlut Koç, M.D.

Department of Cardiology, Health Sciences University, Adana Health Practices and Research Center, Adana, Turkey

e-mail: dryahyakemalicen@gmail.com

doi: 10.5543/tkda.2019.44903

Conflict of interest: None declared.

References

1. İçen YK, Dönmez Y, Demirtaş AO, Koca H, Ardıç ML, Koç AS, et al. Ischemic changes in lead aVR is associated with left ventricular thrombus or high-grade spontaneous echocontrast in patients with acute anterior myocardial infarction. Turk Kardiyol Dern Ars 2019;47:168–76.
2. Warner RA, Hill NE, Mookherjee S, Smulyan H. Diagnostic significance for coronary artery disease of abnormal Q waves in the "lateral" electrocardiographic leads. Am J Cardiol 1986;58:431–5.
3. Al-Zaiti SS, Fallavollita JA, Canty JM, Carey MG. The prognostic value of discordant T waves in lead aVR: A simple risk marker of sudden cardiac arrest in ischemic cardiomyopathy. J Electrocardiol 2015;48:887–92.
4. Tanaka Y, Konno T, Tamura Y, Tsuda T, Furusho H, Takamura M, et al. Impact of T wave amplitude in lead aVR on predicting cardiac events in ischemic and nonischemic cardiomyopathy patients with an implantable cardioverter defibrillator. Ann Noninvasive Electrocardiol 2017;22.
5. Ratheendran AC, Subramanian M, Bhanu DK, Prabhu MA, Kannan R, Natarajan KU, et al. Fragmented QRS on electrocardiography as a predictor of myocardial scar in patients with hypertrophic cardiomyopathy. Acta Cardiol 2019:1–5.
6. Das MK, Saha C, El Masry H, Peng J, Dandamudi G, Mahenthiran J, et al. Fragmented QRS on a 12-lead ECG: a predictor of mortality and cardiac events in patients with coronary artery disease. Heart Rhythm 2007;4:1385–92.
7. Ozcan F, Turak O, Canpolat U, Kadife I, Avci S, Işleyen A, et al. Myocardial tissue perfusion predicts the evolution of fragmented QRS in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention. Ann Noninvasive Electrocardiol 2014;19:454–61.