

Author's Reply

Non-invasive electrocardiographic methods for assessment of atrial conduction heterogeneity in ankylosing spondylitis

Dear Editor,

We would like to thank the authors for the letter entitled "Supraventricular arrhythmia risk in ankylosing spondylitis patients" regarding with our manuscript published in your distinguished journal¹. In current study, we used P wave duration and P-wave dispersion (Pd) for evaluation of supraventricular arrhythmia risk in ankylosing spondylitis. P wave duration is known to have significant correlations with the longest duration of the right atrial electrograms, the maximal number of their fragmented deflections and the repetitive atrial firing zone²⁻⁵. Although markedly prolonged intra- and interatrial conduction time can be recognized by prolongation of the surface P wave duration, the question arises as to whether inhomogeneous atrial conduction could be identified by variation in P wave duration between differently oriented surface ECG leads⁵. The signal-averaged ECG (SAECG) is a computerized technique for detecting subtle abnormalities in the surface ECG that are not visible with naked eye. The SAECG is derived by computing the arithmetic mean of multiple ECG complexes. This process increases the signal-to-noise ratio of cardiac potentials and enables the detection of much smaller signals than would otherwise be discernible from the surface ECG⁶. A resting ECG is recorded in the supine position using an ECG machine equipped with SAECG software; this can be done by a physician, nurse, or medical technician. Unlike standard basal ECG recording, which requires only a few seconds, SAECG recording requires a few minutes (usually about 7-10 minutes), as the machine must record multiple subsequent P and QRS potentials to remove interference due to skeletal muscle and to obtain a statistically significant average trace⁶. Signals from the His bundle as well as subtle abnormalities of atrial or ventricular complexes, anomalies not visualized on a surface ECG, are detectable using the SAECG. The SAECG is very useful in evaluating the risk for atrial arrhythmias. Studies suggest that a prolonged SAECG P-wave, equivalent to "atrial late potentials", may identify patients at risk for atrial fibrillation^{1,5,6}. Because of these advantages we preferred to use this electrocardiographic modality in our research.

P-wave dispersion (Pd) constitutes a major contribution to the field of noninvasive electrocardiology and is defined as the difference between the longest and the shortest P-wave duration recorded from multiple different surface ECG leads^{5,6}. The Pd has received increasing attention and has been examined in a broad range of clinical settings including cardiovascular and non-cardiovascular diseases^{7,8}. Pd can be calculated by measurements on paper or computerize methods. Manual measurement with hand-held calipers performed by increasing the ECG rate to 50 mm/s and the voltage to 1 mV/cm, accompanied by use of magnification. However, hand-held caliper measurements have less accuracy compared with digital measurements. Comparing manual and digital measurements, for maximum P wave duration measurements, the intraobserver variability were reduced from 15% to 5% and the interobserver relative errors were diminished from 16% to 8%. Similarly, the intraobserver variability for Pd were reduced from 20% to 8% and from 26% to 10% for interobserver comparing manual and digital measurement acquisition²⁻⁵. In our study, we assessed the Pd with manual measurements. Although, this might be a relative limitation for the study, we are an experienced group for noninvasive electrocardiology with low intraobserver and interobserver variability for Pd measurement.

Ankylosing spondylitis (AS) is a seronegative arthritis that affects mainly young men, with many cardiac manifestations including aortitis causing aortic regurgitation, myocarditis causing conduction disturbances, and increased myocardial fibrosis causing abnormalities of left ventricular relaxation and pericarditis could be seen in AS. Sinus node dysfunction and atrial and ventricular arrhythmias are reported infrequently^{1,9}. In our previous research⁹, we compared common

echocardiographic indices of left ventricular diastolic function between patients with AS and control subjects. There was no statistically significant difference in our previous work regarding the diastolic indices. However, study population was small and advanced echocardiographic imaging modalities were not used. Echocardiographic evaluation of electrical events especially atrial electromechanical delay (AEMD) is relatively novel subjects in cardiac ultrasound practice. Recent developments in tissue Doppler echocardiography, it is possible to assess precise analysis of atrial mechanical events from different regions with a high temporal resolution. Intra-left AEMD and inter-AEMD were examined in several investigations and it has been shown that it might predict paroxysmal atrial fibrillation^{10,11}. Acar et al¹² demonstrated that atrial electromechanical coupling intervals were prolonged in AS patients. This study also indicated significant correlation between interatrial electromechanical coupling interval with left ventricular diastolic function parameters and left atrium diameter.

Conflict of Interest

The Authors declare that they have no conflict of interests.

References

- 1) AKSOY H, OKUTUCU S, SAYIN BY, ERCAN EA, KAYA EB, OZDEMIR O, INANICI F, AYTEMIR K, OTO A. Assessment of cardiac arrhythmias in patients with ankylosing spondylitis by signal-averaged P wave duration and P wave dispersion. *Eur Rev Med Pharmacol Sci* 2016; 20: 1123-1129.
- 2) AYTEMIR K, AMASYALI B, KOSE S, KILIC A, ABALI G, OTO A, ISIK E. Maximum P-wave duration and P-wave dispersion predict recurrence of paroxysmal atrial fibrillation in patients with Wolff-Parkinson-White syndrome after successful radiofrequency catheter ablation. *J Interv Card Electrophysiol* 2004; 11: 21-27.
- 3) AYTEMIR K, OZER N, ATALAR E, SADE E, AKSÖYEK S, OVÜNÇ K, OTO A, OZMEN F, KES S. P wave dispersion on 12-lead electrocardiography in patients with paroxysmal atrial fibrillation. *Pacing Clin Electrophysiol* 2000; 23: 1109-1112.
- 4) MAGNANI JW, WILLIAMSON MA, ELLINOR PT, MONAHAN KM, BENJAMIN EJ. P wave indices: current status and future directions in epidemiology, clinical, and research applications. *Circ Arrhythm Electrophysiol* 2009; 2: 72-79.
- 5) OKUTUCU S, AYTEMIR K, OTO A. P-wave dispersion: what we know till now? *JRSM Cardiovasc Dis* 2016; 5: 2048004016639443.
- 6) DEVECİ OS, AYTEMİR K, OKUTUCU S, TULUMEN E, AKSOY H, KAYA EB, EVRANOS B, KABAKCI G, TOKGOZOĞLU L, OTO A, OZKUTLU H. Evaluation of the relationship between atrial septal aneurysm and cardiac arrhythmias via P-wave dispersion and signal-averaged P-wave duration. *Ann Noninvasive Electrocardiol* 2010; 15: 157-164.
- 7) AKDAG S, CIM N, YILDIZHAN R, AKYOL A, OZTURK F, BABAT N. Two markers in predicting the cardiovascular events in patients with polycystic ovary syndrome: increased P-wave and QT dispersion. *Eur Rev Med Pharmacol Sci* 2015; 19: 3508-3514.
- 8) RUSSO V, DI MEO F, RAGO A, PAPA AA, MOLINO A, MOSELLA M, POLITANO L, RUSSO MG, NIGRO G. Paroxysmal atrial fibrillation in myotonic dystrophy type 1 patients: P wave duration and dispersion analysis. *Eur Rev Med Pharmacol Sci* 2015; 19: 1241-1248.
- 9) KAYA EB, OKUTUCU S, AKSOY H, KARAKULAK UN, TULUMEN E, OZDEMIR O, INANICI F, AYTEMIR K, KABAKCI G, TOKGOZOĞLU L, OZKUTLU H, OTO A. Evaluation of cardiac autonomic functions in patients with ankylosing spondylitis via heart rate recovery and heart rate variability. *Clin Res Cardiol* 2010; 99: 803-808.
- 10) OKUTUCU S, EVRANOS B, AYTEMİR K, KAYA EB, DEVECİ OS, DENİZ A, AKSOY H, KABAKCI G, TOKGOZOĞLU L, OZKUTLU H, OTO A. Relationship between atrial septal aneurysms and atrial electromechanical delay. *Int J Cardiovasc Imaging* 2011; 27: 505-513.
- 11) DENİZ A, YAVUZ B, AYTEMİR K, HAYRAN M, KOSE S, OKUTUCU S, TOKGOZOĞLU L, KABAKCI G, OTO A. Intra-left atrial mechanical delay detected by tissue Doppler echocardiography can be a useful marker for paroxysmal atrial fibrillation. *Echocardiography* 2009; 26: 779-784.
- 12) ACAR G, SAYARLIOĞLU M, AKÇAY A, SOKMEN A, SOKMEN G, ALTUN B, NACAR AB, GUNDUZ M, TUNCER C. Assessment of atrial electromechanical coupling characteristics in patients with ankylosing spondylitis. *Echocardiography* 2009; 26: 549-557.

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