

Clinical Implication of Atrial Repolarization: Limitations of the Conventional Electrocardiogram in its Interpretation

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The fact that in 60 years there were found only 38 suitable articles in the world literature on atrial repolarization demonstrates the scant investigation in this field and shows the great efforts we should exert into further investigation on atrial repolarization [1]. There are certain difficulties in the clear estimation of atrial repolarization in conventional electrocardiogram (ECG). There are other processes that may influence and further jeopardize its correct recognition.

In most cases, atrial repolarization is not evident on the 12 leads conventional ECG because it is masked and hidden within the great potential of the QRS complex corresponding to ventricular depolarization. In addition, poorly coupled muscle fibers in diseased atrial myocardium with progressive fibro-degenerative changes may lead to abnormal electrophysiological characteristics. Connective tissue septa encircling fiber groups reflect sites where electrical coupling between adjacent fibers is difficult to occur, leading to conduction delay and block. The microarchitecture and anisotropic characteristics of the diseased human atrium may cause inhomogeneous and discontinuous propagation of the impulse [2,3]. These electrophysiological alterations produce abnormal changes in P wave morphology that may also change in unrecognized manners atrial repolarization.

The P wave duration is independent of wall tension, changes in the intravascular volume, or metabolic conditions, but is affected by changes in autonomic tone. The STa segment which is the interval from the end of the P wave to the beginning of the atrial repolarization wave (Ta) may also be masked in cases with the prolongation of the PR interval by a delayed conduction in the AV node, and also by the prolongation of atrial conduction times in cases of advanced interatrial block due to some lesions in the Bachman's bundle which determines the diphasic morphology of the P wave in the inferior leads [4,5]. Therefore, the inherent and intrinsic alterations of atrial repolarization are very difficult to separate from other alterations in the atrial and atrial-nodal conduction system. On the other hand, the great difficulty in the quantitative measurement of atrial repolarization with conventional auxiliary diagnostic methods makes its importance and implication difficult to determine. Debbas NMG, *et al.* [6] made interesting quantitative measurements of atrial repolarization in humans, and even determined a correction formula for PTa. However, these findings cannot be extrapolated to the vast majority of patients since they were determined in 51 patients with complete atrioventricular (AV) block. The durations of the different P wave intervals were measured from non-conducted atrial events easily seen in their patients with AV block. The segments and waves of atrial repolarization, STa, Ta, and their sum PTa were well visible, highly readable, and reliably measured in these patients with complete AV block, but that is not the case in the vast majority of patients with different entities.

The P-wave signal-averaged ECG noninvasively detects atrial conduction delay, and it was also found to be beneficial in certain atrial arrhythmias and a potent, accurate, and independent predictor of atrial fibrillation [7,8]. We wonder, what is the future perspective of this

interesting field on atrial repolarization? What would be the contribution to this field of the P wave signal-averaged ECG, or multichannel high-resolution surface ECG, or computer simulation involving a structurally realistic anatomical model of the human atria, or a combination of these and other auxiliary diagnostic methods? [9,10].

It is imperative to search for appropriate tools to accomplish reliable measurements of atrial repolarization. It is likely that until we can perform an effective, stable and predictable quantitative measurement of atrial repolarization in all healthy subjects and patients with various diseases, the true clinical implication of atrial repolarization remains to be determined.

Declaration of Interest

None.

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