

Susceptibility to Paroxysmal Atrial Fibrillation: A Study using Sinus Rhythm P Wave Parameters

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Whereas many studies have used the signal-averaged P wave, this work aims to determine whether other electrocardiographic characteristics resulting from the analysis of the P wave in ECG recorded during sinus rhythm could be associated with paroxysmal atrial fibrillation susceptibility. Furthermore, the Euclidean distance between beat-to-beat P waves which has been rarely addressed in this context, is studied. The database used includes 42 two-minutes ECG recorded during sinus rhythm. It comprises 30 ECG from healthy male subjects (H group, mean age = 34 ± 13 years, mean heart rate = 67.5 ± 12.6 bpm) from the PTB database available in Physionet (sampling frequency 1 kHz) and 12 ECG from male patients subject to paroxysmal atrial fibrillation (PAF group, mean age = 61 ± 8 years, mean heart rate = 53.2 ± 7.9 bpm) from the Clinic Im Park in Switzerland (sampling frequency 977 Hz). Pre-processing was applied in order to reduce the noise and baseline wander. Several electrocardiographic characteristics were extracted on lead V1: average values of P width (from the P onset to the end of P) and P-R interval (from the P onset to the R peak) on all beats, and the Euclidean distance between beat-to-beat P waves. Means and standard deviations of each feature were computed for each group. Significant differences between the healthy and the PAF groups were observed on the P width (mean_H = 111.5 ± 15.8 ms and mean_PAF = 156.2 ± 26.3 ms; p-value < 0.0005), on the P-R interval (mean_H = 210.8 ± 13.2 ms and mean_PAF = 259 ± 28 ms; p-value < 0.0005), and on the variance of the Euclidean distance between beat-to-beat P waves (mean_H = $2.42e-2$ and mean_PAF = $1.35e-1$; p-value < 0.1). Using P width and P-R interval parameters, the two groups are classified at 90% using Fisher's linear discriminant. In conclusion, the ECG recorded during sinus rhythm provides valuable markers for paroxysmal atrial fibrillation susceptibility, in particular the P width and the P-R interval. Moreover, the beat-to-beat variability of P wave parameters can be useful for this purpose, specially the variance of the Euclidean distance between beat-to-beat P waves. These preliminary results could be helpful in atrial fibrillation prevention.