

Compound method of signal-averaged ECG of P-wave for patient identification with paroxysmal atrial fibrillation

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Abstract: Typical parameters for identification of patients (pts) with paroxysmal atrial fibrillation (PAF) by using signal-averaged P-waves are time duration of filtered P-wave (hfP) and root mean square voltages of the last 20 ms of P-wave (RMS 20). Those parameters have a big standard deviation that makes difficulty to find a difference between PAF patients (group 1) and healthy subjects (group 2). The aim of our study was to use the compound method of signal-averaged ECG of P-wave for patient identification with paroxysmal atrial fibrillation.

INTRODUCTION

Typical parameters for identification of patients (pts) with paroxysmal atrial fibrillation (PAF) by using signal-averaged P-waves are time duration of filtered P-wave (hfP) and root mean square voltages of the last 20 ms of P-wave (RMS 20). Those parameters have a big standard deviation that makes difficulty to find a difference between PAF patients (group 1) and healthy subjects (group 2).

METHOD

HR ECG from 99 pts was analyzed: 46 pts with PAF (group 1), and 53 healthy subjects (group 2). For P-wave filtration the Infinite Impulse Response filter (IIR - Simson method), and Finite Impulse Response filter (FIR - with Kaiser window) was used. Also new method of filtration is applied, it means that for P-wave segment is calculated the square root from sum of squared signal velocities from each lead (vector p).

For a better description of the P-wave vector shape we were used 11 parameters (some known, some new) from which we construct in 11-dimensional space the multidimensional set of discriminatory signs of filtered P-wave. These parameters are also used in the compound method, it means that the multidimensional set of discriminatory signs (MSDS) was constructed by using parameters or from IIR filtration and from vector p, or from FIR filtration and from vector p.

For comparison of all method the multidimensional variables analysis and MANOVA was used. That MSDS is not sensitive even to big statistical fluctuations of each parameter it can be say that the method of discriminatory analysis in multidimensional space allows to differentiate the groups.

RESULTS:

group 1 vs group 2	3 parameters	11 parameters
Simson method (IIR filter)	76%	78%
compound method	80%	84%

The results for compound method are:

- sensitivity - 84%,
- specificity - 84%,
- predictive value - 80%,
- accuracy - 84%.

DISCUSSION

Our study indicate that the higher value of sensitivity, specificity, predictive value and accuracy is correlated with the increase of the number of parameters, which are used to description P-wave vector shape. Compound method (with FIR filtration) and more then three parameters give the possibility for better pts identification with PAF.

CONCLUSION

We conclude that the multidimensional set of discriminatory signs of filtered P-wave is the best for identification of pts with PAF. The compound method seems to be not so sensible for statistical fluctuation of P-wave parameters and it could applicable for analysis of P-wave by HR ECG.

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