

The best digital filter for P-wave signal-averaged ECG

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Abstract: The aim of our study was to assess the optimal filter for P-wave signal-averaged ECG examination of patients (pts) with ischemic heart disease and paroxysmal atrial fibrillation (PAF+), and without paroxysmal atrial fibrillation (PAF-).

INTRODUCTION

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METHOD

We have adapted for P-wave signals study our earlier method used for ventricular late potentials examination [1,2].

High resolution ECG was recorded from orthogonal Frank leads (X,Y,Z). Averaging was made for 150-200 beats. The gain of the amplifier was 5000 and the noise input was $<0.6\mu\text{V}$. Ventricular ectopic beats and gross noise were eliminated by conventional QRS template-matching program before proceeding to the P-wave recording.

We have studied 5 kinds of digital filtering:

1. Infinite Impulse Response (IIR) filter - bi-directional Butterworth high-pass filter (4 pole) 45-150 Hz, according Simson => S;
2. Finite Impulse Response (FIR) filter with Kaiser window 45-150 Hz => K;
3. Digital filtering by using the square root from sum of squared signal velocities from each lead => P;
4. Compound filtering connected results of S filtering and P filtering => SP;
5. Compound filtering connected results of K filtering and P filtering => KP.

RESULTS

Using this kinds of digital filtering we have examined 62 pts, it means 37 pts with PAF+ (group 1), and 25 pts with PAF- (group 2). Because parameters which described filtered P-wave have great statistical fluctuations we have enlarged the number of this parameters up to 14. We have received 90% -98% of right decision and good differentiation between groups for filtering type K and type KP if we have taken to pts classification more than 5 parameters.

DISCUSSION

During our study we compare all receiving results. This results suggested that filter for P-wave signal averaged ECG have to be characterized by: linear characteristic, deep and steep slope frequency characteristic and amplitude characteristic. We can observed increasing the value of all statistical parameters for both compound method.

CONCLUSION

Our results suggest that for P-wave signal-averaged ECG examination it will be necessary changed the method of filtration (our compound method give about 90% of right decision) and increasing calculating parameters numbers.

Acknowledgments

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