ECG BASED DETECTION OF BODY POSITION CHANGES

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Abstract—**Changes in body position are sometimes mistaken for as myocardial ischemia during ambulatory ECG monitoring. Two different methods for detecting body position changes based on spatial and scalar approaches are investigated. The results show that reliable detection is possible in more than 90 % of the cases.**

I Introduction

Changes in body position can be misclassified by available commercial ischemia monitoring equipment used in the intensive care unit. This observation has been pointed out in a number of recent papers [1], [2]. This paper presents two methods which deal with the issue of detecting BPCs: one technique is done using a spatial approach by estimating rotation angles of the electrical axis while the other uses scalar-lead signal representation based on the Karhunen–Loéve transform (KLT).

II Methods

2.1 Spatial approach using rotation angles

The spatial approach assumes that a BPC will be reflected as a shift in the electrical axis of the heart. The rotation angles, $\varphi(t)$, are estimated optimally in the least squares sense from vectorcardiographic leads, cf. Fig. 1(a) [3]. Detection of BPCs were done using matched filtering, under the assumption that an axis shift is reflected as a step, in combination with an amplitude detector.

2.2 Scalar approach based on KLT

The KLT technique applied to the different waves of the ECG provides a useful tool to characterize their morphologic changes [4]. The scalar detector structure calculates a distance function, $\mathcal{F}(t)$, of the KLT coefficients series obtained for the QRS and ST-T complexes (see Fig. 1(b)), and then a matched filter followed by a detector based on the use of a constant false alarm rate (CFAR) strategy is applied.

III Material and Results

In order to validate the two methods for BPC detection a data base containing 20 high-resolution ECGs 20 minutes duration recorded from subjects performing a predefined schedule of BPCs was considered.

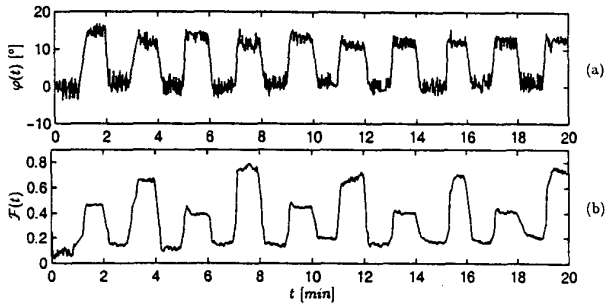

Fig. 1. Example of, in (a) angle estimates and in (b) KLT function estimates. In the figures, a BPC takes place every minute according to the scheme *supine* → *right side* → *supine* → *left side* and so on.

The evaluation of detector performance was done in terms of sensitivity (S) and positive predictivity ($+P$), cf. Table 1.

Table 1. BPC detector performance statistics.

detector	S	+P
Spatial	89 %	98 %
Scalar	94 %	96 %

IV Conclusion

This paper has shown that reliable detection of BPCs is possible. Further research is needed to study the detector performance in ischemic recordings in order to assess the false alarm rate.

References

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