

Comparison of Standard and Derived 12-Lead Electrocardiograms Registered by a Simplified 3-Lead Setting with Four Electrodes for Diagnosis of Coronary Angioplasty-induced Myocardial Ischaemia

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Keywords

Electrocardiograms (ECGs), myocardial infarction, patient monitoring, EASI lead ECG, percutaneous transluminal coronary angioplasty, four electrodes set 12-lead ECG, 12-lead ECG, cardiovascular patients

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Electrocardiograms (ECGs), derived by the transformation of three bipolar quasi-orthogonal leads, have according to EASI lead ECG been introduced for many years for use in emergency situations and for the monitoring of patients during the acute phase of myocardial infarction. Theoretically, a further reduction and simplification of the classic EASI setting of five electrodes may even improve acceptance of the derived 12-lead ECG in these critical situations, especially in the telemedical use and for monitoring of cardiovascular patients. The objective of the present study was to evaluate the comparability of the 12-lead ECG derived by a system that reduces the classic EASI setting from five to four electrodes with the standard 12-lead ECG in the detection of acute myocardial ischaemia induced during percutaneous transluminal coronary angioplasty (PTCA).

Methods

To determine whether a 12-lead ECG derived from a reduced EASI setting using only four electrodes would demonstrate typical ST-segment changes of ischaemia during percutaneous coronary intervention (PCI), 24 patients with overall 148 episodes of balloon-induced myocardial ischaemia were monitored with continuous 12-lead ST-segment monitoring during PCI. Additionally, a derived 12-lead ECG was registered by the four electrodes system. Two blinded cardiologists, not involved in the intervention, compared both ECGs for each patient.

Results

Of the 148 episodes of balloon inflation recorded with the derived ECG, 104 (70.3 %) were associated with typical and significant ischaemic ST-segment changes during balloon inflation. The amplitudes of these ST deviations were similar to those observed during transient myocardial ischaemia observed in clinical settings (median peak ST deviation, 234 microV). There was an agreement regarding presence or absence of ischaemia in 147 of the 148 episodes of ischaemia recorded, with both derived and standard electrocardiographic methods (>99 % agreement). With use of the standard ECG as the 'gold standard' for ischaemia diagnosis, there was no false-negative result (0 %) and only one false-positive result (0.7 %) with the derived ECG. There was no significant difference between the two techniques by linearity tests ($p > 0.1$). Bland-Altman analysis showed no significant bias. Moreover, both methods demonstrated 100 % concordance with respect to localisation of myocardial ischaemia (anterior, inferior and lateral).

Conclusions

The new four electrodes set 12-lead ECG is as an alternative to the standard 12-lead ECG with 10 electrodes in emergency situations and for monitoring of cardiovascular patients. ■