

# Machine Learning Approach to Assess the Performance of Patch Based Leads in the Detection of Ischaemic Electrocardiogram Changes

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**Background:** We have previously reported on the potential of patch based ECG leads to observe ECG changes typical in myocardial ischaemia/infarction. Specifically, we investigated where on the torso we could maximise the magnitude of change in J-point amplitudes in sub-100 mm short spaced bipolar leads (SSL). In this study we aim to assess the utility of ECG changes in these leads toward the detection of myocardial ischaemia.

**Method:** Body surface potential maps (BSPM) from subjects (n=45) undergoing elective percutaneous coronary angioplasty (PTCA) were used. Two recordings were provided for each subject: one during baseline and another during peak balloon inflation (PBI). The short spaced lead that was previously identified as having the greatest ST-segment change between baseline and PBI was selected as the basis for the patch based lead system. To increase spatial sampling, all other possible bipolar leads available within the same 100 mm region were included. This resulted in six bipolar leads. We constructed a feature set of J-point amplitudes for each lead. A decision tree (J48/C4.5), KNN and Naive Bayes algorithms were used to classify ischaemic type changes in different combinations of the six SSLs. Leave-one-out cross-validation was employed in our analysis. Current 12-lead ECG criteria were applied to 12-lead ECGs for the same subjects to benchmark performance.

**Results:** The previously identified single short spaced lead achieved sensitivity and specificity of 73% and 84% respectively using a Naive Bayes classifier. Adding other combinations of leads to this did not improve performance significantly. The 12-lead ECG performance was 62/93% (sensitivity/specificity).

**Conclusion:** This study suggests that short spaced leads can be sensitive to myocardial ischaemia. However, due to the short distance between leads, they lack the specificity of the 12-lead ECG. Further work must be done to identify features specific to ischaemia in short spaced leads.