An Automated Algorithm for the Detection of Atrial Fibrillation in the Presence of Paced Rhythms

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Background: 2-5% of 12-lead diagnostic ECGs acquired in hospital are from patients with pacemakers. A significant percentage of these patients are in atrial fibrillation or flutter (AF). Many automated diagnostic algorithms abort analysis when paced rhythms are identified, so do not attempt detection of AF. In the presence of pacing, detection of AF can often be difficult, as there may only be subtle clues due to the pacing artifact and regular rhythm due to pacing. However, identification of AF is quite valuable, since the patient is at higher risk for stroke. The Philips DXL automated diagnostic algorithm contains logic for detection of AF in the presence of paced rhythms.

Method: The algorithm uses QRST subtraction with frequency domain analysis of the residual. A decision tree classifier uses features from the power spectrum, as well as RR irregularity measures from non-paced beats (if present).

A training database was developed containing 355 pacemaker ECG records with 265 presenting AF. The testing database was selected from an initial set of 42,817 sequential ECGs from the emergency department of a teaching hospital. All ECGs classified to have any ventricular pacing (intermittent, continuous, or dual) by the automated algorithm were used to create the testing subset of 1,057 ECGs. In this paced test set, 194 cases (18%) were identified by two expert readers to contain AF.

Results: On the training database of 355 paced ECGs, the algorithm had an AF detection sensitivity of 76%, positive-predictive value of 82%, and specificity of 73%. On the testing set of 1,057 paced ECGs, the algorithm had AF sensitivity of 71%, PPV 83%, and specificity 97%.

Conclusion: Automated detection of AF in the presence of pacing is a clinically important and valuable tool to assist cardiologists in ECG diagnosis, and can be done with a high degree of accuracy.