

## **Electrogram Changes Precede Atrial Fibrillation After Coronary Artery Bypass Graft**

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Thirty percent of the patients that undergo coronary artery bypass graft (CABG) surgery develop atrial fibrillation (AF), increasing cost and morbidity. We hypothesize that quantitative features can identify ECG segments immediately preceding AF onset (AFO).

Patients were monitored with continuous Holter recordings from surface lead II and intracardiac atrial electrograms for 48 hours following CABG. The dataset consisted of 30 patients without AF and 16 AF patients, from which 9 pre-AFO epochs were recorded. Five minute clips of sinus rhythm ECG immediately preceding AFO were compared to clips at 0-, 12-, 24-, and 36-hours post-operatively (non-AFO) in patients who remained in sinus rhythm. P waves and QRS complexes were annotated and used to extract ECG segments (RR,RP,PR,PP) and heart rate variability measures from which 539 temporal, frequency, and nonlinear domain features were calculated. A genetic algorithm, using leave-one-out validation, was used to train a  $k$ -nearest neighbor (kNN) classifier to determine the best features to distinguish pre-AFO from non-AFO clips for a given time after surgery.

The genetic algorithm found the best feature set for class separation to be the percentage of ectopic beats and the maximum of the Shannon Entropy of the surface lead II's PP segments. Classification accuracies for these features using a kNN were 84%, 82%, 84%, and 91% for the four clips, respectively. They have a sensitivity of 66%, 55%, 66%, and 66% and a specificity of 90%, 90%, 90%, and 100% for separating pre-AFO from non-AFO clips.

These results suggest that it may be possible to distinguish sinus rhythm segments immediately preceding AF from segments that do not herald AF in post-operative patients. We have found that increased presence of ectopic beats and changes in the signal's information theory domain contribute to this goal. A prospective study, including larger numbers of patients, will be required to validate this finding.