System for Estimating the Risk of Atrial or Ventricular Arrhythmias Based on ECG Analysis

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Technology description

Invention Summary:
This invention is a computerized procedure/processing of electrocardiographic signals to provide cardiologists with a means to assess abnormal electrical conduction in the heart, an established marker of arrhythmia risk. Although focused on the P wave (atrium), the analysis applies to the QRS (ventricle) as well. In patients with disease and those at risk for atrial fibrillation or flutter, P waves have many small inflections that are markers of underlying discontinuous conduction, an arrhythmogenic substrate known to increase arrhythmia risk. The basis of the invention involves the use of signal averaging to achieve improved P wave signal-to-noise ratio and a simple, novel approach to quantify the number and character of significant P wave inflections. Arrhythmia risk assessment is based on the current wisdom that high risk is associated with many small inflections and that low risk is associated with a small number of large inflections.

Application area

Atrial fibrillation (AF) is a common arrhythmia with increasing incidence with age and presence of heart disease. Left untreated, the incidence of stroke, heart attack and heart failure is very high, and after treatment, risk remains high. Several of the known causes of increased risk result in abnormal conduction (propagation of the electrical impulses in the atria and ventricles) that can be observed in signals measured directly from the heart.
This invention provides a quick, inexpensive, noninvasive test to assess the abnormal conduction arrhythmogenic substrate for AF and is directed toward: a) screening to identify patients potentially at risk of developing AF; b) stratifying patients already in AF into treatment groups (ablation versus medical therapy); and c) stratifying patients who have already been ablated into additional ablation versus medical therapy groups. The same technology is also applicable to assessing abnormalities of ventricular conduction and would provide physicians managing ventricular arrhythmia patients with actionable information not currently available.

Advantages

Present methods for atrial assessment and AF ablation require expensive, high-risk, lengthy procedures in hospital operating rooms and experimental MRI imaging techniques to detect and assess abnormal conduction and risk. Related technology for assessing ventricular conduction abnormalities is inexpensive and low risk but addresses only one part of ventricular abnormality. This invention will allow rapid, inexpensive, noninvasive (no risk) assessment as a screening and assessment tool.
This technology requires only a 5-15 minute, continuous, high-resolution (16 bit, 1000 Hz sample rate) ECG recording from 12-15 leads and computer processing of the signal.
The invention may be used to assess the arrhythmogenic substrate for either atria or ventricles.

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