

# Use of the electrocardiogram for prediction of arrhythmia outcome in atrial fibrillation

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## **Valorisation**

### **Atrial fibrillation**

Atrial fibrillation (AF) is the most common cardiac arrhythmia with an estimated prevalence of approximately 3% in adults aged 20 years and older. The prevalence of AF increases with advancing age. Furthermore, AF is independently associated with an increase in all-cause mortality and is also associated with increased morbidity, such as heart failure and stroke. As a consequence, a large percentage of healthcare costs is spent on AF.

### **Diagnosis of incident atrial fibrillation**

Intensified rhythm monitoring of patients with a high likelihood of AF might lead to an earlier diagnosis. With earlier diagnosis of the arrhythmia, adequate treatment such as anticoagulation can be initiated at an earlier stage which might prevent disabling strokes in these patients. The problem is the identification of patients with a high likelihood of developing AF. The first part of this thesis is about the identification of patients with a history of atrial fibrillation. P-wave parameters identified in this thesis are able to classify patients with a previous history of AF more accurately than currently used ECG-parameters. The selection of parameters that are able to discriminate between patients with and without AF is a first step towards an earlier diagnosis of the arrhythmia.

To investigate whether these parameters are indeed able to identify patients with a high likelihood of developing AF, these parameters should be measured in a population based study.

For the implementation of these new P-wave parameters long recordings, without low-pass filters and with a high sampling frequency are required. Furthermore, alternative or additional leads are advocated. At this point, these ECG-recording devices are mainly used for research purposes. The analyses in this thesis were done offline. However, for the implementation in everyday clinical practice the ECG-recording devices should have an integrated software package to analyse the P-wave complexity instantaneously. Further research on software development is required.

### **Guiding treatment of atrial fibrillation**

For the treatment of AF a rate- and rhythm control strategy can be adopted. If a rhythm control strategy is preferred, the decision on the type of rhythm control strategy (medication, electrical cardioversion, catheter and/or surgical

ablation or a combination of strategies) is usually based on the preference of the physician and patient. Unfortunately, long-term results of these strategies are disappointing in some strategies (electrical cardioversion) while other strategies (such as ablation) have superior long-term results but with possible complications of the treatment itself.

Identifying patients likely to respond to a certain treatment and therefore selecting the appropriate treatment could enhance efficacy and also prevent unnecessary overtreatment.

We showed that the ECG-derived AF frequency and complexity parameters identified in this thesis can predict success of rhythm control therapy in a wide variety of patient populations. These complexity parameters can be calculated on a standard 10 seconds 12 lead ECG which makes them easy to use in everyday clinical practice. For example, the dominant frequency of the atrial signal can already be calculated on some ECG-recording devices. These parameters still need to prove their ability of selecting the appropriate treatment for an individual patient. Future research should address this question.

### **Guiding catheter ablation**

In patients with paroxysmal AF pulmonary vein isolation is the established ablation strategy. However, in a subset of patients with persistent AF pulmonary vein isolation alone proves not be sufficient. Selecting the appropriate lesion set in these patients remains a challenging task. Although we showed that endocardial atrial frequencies from the atrial appendages can be measured on the body surface using a standard 12 lead ECG, the spatial resolution of a 12 lead ECG seems to be limited for this task. Body surface potential mapping has the advantage of a high spatial resolution and might be able to identify potential ablation targets in a patient. Especially ECG-imaging which incorporates the patient's anatomy might be used for this purpose. Currently studies addressing this question are carried out.