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Christian Meyer & Helmut Pürerfellner

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Continuous heart rhythm monitoring to detect and quantify atrial fibrillation

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Christian Meyer

Department of Internal Medicine/Cardiology, Public Hospital Elisabethinen, Academic Teaching Hospital of the Universities of Innsbruck and Graz, Fadingerstrasse 1, A-4010 Linz, Austria
and
Department of Internal Medicine, Division of Cardiology, Pneumology, and Angiology, Heinrich-Heine University Düsseldorf, Düsseldorf, Germany

Helmut Pürerfellner

Author for correspondence:
Department of Internal Medicine/Cardiology, Public Hospital Elisabethinen, Academic Teaching Hospital of the Universities of Innsbruck and Graz, Fadingerstrasse 1, A-4010 Linz, Austria
Tel.: +43 732 7676 4917
Fax: +43 732 7676 2106
helmut.puererfellner@elisabethinen.or.at

"…technologies for the reliable detection of atrial fibrillation irrespective of symptoms are warranted, both for clinical and scientific reasons."

Atrial fibrillation (AF) is the most common arrhythmia, and no current therapy is ideal for the control of this condition. This is important since AF increases the risks of stroke, heart failure and death. Thus, new approaches to improving the management of AF continue to be the subject of interest and investigation.

Most commonly, AF is diagnosed and monitored by routine ECG or ambulatory Holter ECG recordings. Of note, the use of these traditional methods to detect AF is limited by the short documentation period covered, and by the well-known high incidence of asymptomatic AF episodes even in patients presenting with highly symptomatic AF [1,2].

Recently, new extended monitoring methods have been introduced, including transtelephonic ECG transmission, 7-day Holter monitoring and 30-day event recording. Nevertheless, the diagnostic yield of these methods is limited. The sensitivity of these monitoring systems ranges between 31 and 70%. It is worth noting that the negative-predictive value is even lower and lies between 21 and 65%. Importantly, there is a clear relationship between the duration of monitoring and the diagnostic yield [3,4]. This observation has important implications for current and future pharmacological and interventional therapeutic attempts intending to cure AF or decrease its burden. Thus, technologies for the reliable detection of AF irrespective of symptoms are warranted, both for clinical and scientific reasons.

The common ECG manifestations of AF include the presence of irregular fibrillatory waves and, in patients with intact atrioventricular conduction, the presence of an irregular ventricular response. This simple latter finding has now opened up new avenues for the development and implementation of algorithms in implantable devices to continuously monitor AF.

Recently, the first implantable leadless cardiac monitor (ICM) with AF detection capabilities has been validated [5]. The Reveal XT Performance Trial (XPECT) tested an algorithm dedicated for AF detection that has been incorporated into a subcutaneous implantable device already being recommended by the current guidelines of the European Society of Cardiology for the evaluation of unexplained syncope (class I or IIa indication depending on the clinical presentation) [6]. This ICM also features detection algorithms for bradyarrhythmias and ventricular tachyarrhythmias.

"…the implantable leadless cardiac monitor seems to be a promising new diagnostic and monitoring tool to manage atrial fibrillation independently of symptoms."

In this ICM short-term validation study, the dedicated AF detection algorithm reliably detected the presence or absence of AF, and the AF burden was accurately quantified. The sensitivity, specificity, positive-predictive value and negative-predictive value were approximately 96, 85, 79 and 97%, respectively. The AF burden measured with the ICM fitted very well with the reference value derived from Holter recordings. The overall accuracy

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of the ICM for detecting AF was 98.5%. These performance metrics have much higher values compared with conventional monitoring methods. Therefore, the ICM seems to be a promising new diagnostic and monitoring tool to manage AF independently of symptoms.

Considering the potential complications of AF, a high sensitivity for AF detection should be the primary aim for an AF detection algorithm. Ziegler and colleagues demonstrated that identification of patients with AF and assessment of AF burden improve as the frequency or duration of intermittent monitoring increase and as the patient's actual AF burden increases [4]. The results of the XPECT trial have shown that even with the ICM, the presence of AF may not be detected in patients with low AF burden when the recording time is short. Therefore, longer recording times are necessary to evaluate the clinical consequences of this observation.

> "...prospective studies are needed to demonstrate the ultimate clinical value of implantable leadless cardiac monitors in special subgroups of atrial fibrillation patients..."

This is important as extensive monitoring capabilities in therapeutic implantable devices (pacemaker and/or implantable cardioverter defibrillators) provide complete disclosure on the effect of therapeutic interventions, including radiofrequency ablation and pharmacological drug treatment in AF patients, which has already been demonstrated by our [7–9] and other groups [1,2].

Clinical studies using the ICM are already underway. The Study of Continuous Cardiac Monitoring to Assess Atrial Fibrillation after Cryptogenic Stroke (CRYSTAL AF) will assess the benefit of continuous monitoring using an ICM compared with optimal standard of care in patients with cryptogenic stroke. In addition, AF patients with an ICM are already included in a multicenter international registry (INSIGHT®XT) to further evaluate the clinical importance and usefulness of this device for AF management in different subgroups. However, prospective studies are needed to demonstrate the ultimate clinical value of ICMs in special subgroups of AF patients, such as before and after AF ablation procedures and during pharmacological treatment focusing on rhythm control.

In summary, the ICM is a promising tool that might improve AF management by advanced detection and characterization of cardiac rhythm disorders, and might thereby guide specific therapy more effectively in the future.

Financial & competing interests disclosure

Helmut Pürerfellner is a consultant for Medtronic. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

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