When is Device-Detected Atrial Fibrillation Actionable?

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KEYWORDS

- Atrial fibrillation • Cardiac implanted electronic devices • Pacemaker • Defibrillator
- Thromboembolism • Stroke

KEY POINTS

- Atrial high-rate episodes (AHREs) are commonly encountered and predict increased thromboembolic risk at durations of 24 hours or less. Shorter cutoffs have been less consistently associated with risk.
- There is no consensus on a single threshold that merits anticoagulation or other treatment. Very short episodes may not require action beyond continued monitoring.
- A more effective approach to risk stratification may integrate atrial fibrillation (AF) features, such as density, duration, and burden, with thromboembolic risk scores, such as CHA_2DS_2-VASc, and other markers of atrial myopathy or hypercoagulability.
- Studies are ongoing to address the use of oral anticoagulation for subclinical AF alone detected by cardiac implanted electronic devices, as well as tailored anticoagulation in response to AHREs in those with a known history of AF.

Atrial fibrillation (AF) is a common cardiac arrhythmia affecting between 2.9 and 7.7 million adults in the United States.[1–3] This prevalence is predicted to increase to between 5.6 and 15.9 million people by 2050. The annual incremental cost of AF has been estimated at $8705 per patient, costing the United States a total of $26.0 billion per year.[4]

AF can occur with or without symptoms, and can lead to hospitalization, dementia, congestive heart failure, and arterial thromboembolism.[5,6] AF is associated with a nearly fivefold increase in stroke.[7] Moreover, strokes that occur in patients with AF are associated with larger infarct size, greater disability, and a higher risk of early death.[8,9] Stroke risk can be more precisely estimated using the risk prediction scores of $CHADS_2$ (ie, congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, prior stroke or transient ischemic attack [TIA] or thromboembolism [doubled])[10] and CHA_2DS_2-VASc (congestive heart failure, hypertension, age ≥ 75 years [doubled], diabetes mellitus, prior stroke or TIA or thromboembolism [doubled], vascular disease, age 65–74 years, sex category).[11,12] Oral anticoagulation with warfarin or novel oral anticoagulant (NOAC) is indicated for patients with a CHA_2DS_2-VASc score of 2 or greater and has been demonstrated to reduce the risk of ischemic stroke.[13–17]

Current guidelines recommend that selection of antithrombotic therapy be made irrespective of

whether the AF pattern is paroxysmal (episodes shorter than 7 days), persistent (episodes longer than 7 days), or permanent (cases in which restoration and/or maintenance of sinus rhythm have been abandoned).[18] There is currently no consensus, however, on how to manage a fourth pattern of subclinical AF detected by cardiac implanted electronic devices (CIEDs) in patients without history of clinical AF (Fig. 1). Awareness of these atrial high-rate episodes (AHREs) has increased alongside increased use of CIEDs,[5] yet there is a paucity of data to guide management in this scenario because patients with CIED-only documented AF have not been included in clinical trials of anticoagulants and other AF therapies. This article provides an overview of device-detected AHREs and outlines the current body of literature, as well as evolving areas of investigation.

## PREVALENCE AND ACCURACY OF ATRIAL HIGH-RATE EPISODES

Episodes of AF can frequently be asymptomatic, which can have major clinical implications because at least a quarter of AF-related strokes present as the first manifestation of AF. Even in patients with an existing diagnosis of AF, most episodes can occur without symptoms.[19–21] Implanted devices represent an increasingly important source of data on these subclinical AF episodes because approximately 400,000 CIEDs are implanted each year in the United States, and there are more than 3 million patients currently living with CIEDs.[22]

In patients without history of AF, the prevalence of AHREs has been observed to be between 10% and more than 50%, depending on the population studied.[23–27] Despite a lack of symptoms, patients with subclinical AF remain at risk for major complications.[28] Indeed, AF detection rates of 30% at 3 years have been reported in patients who presented with cryptogenic stroke and no history of AF.[29,30]

Several investigators have reported on the accuracy of AHREs in the diagnosis of atrial tachyarrhythmias (ATs), demonstrating excellent sensitivity in most series. One study of 40 subjects with tachycardia-bradycardia syndrome and permanent pacemakers found mode switching algorithms to be 98.1% sensitive and 100% specific for the diagnosis of ATs compared with Holter monitor data. The algorithms detected 98.9% of the total duration of AF and 96.4% of the total duration of atrial flutter.[31] Another study of 2 models of implanted devices found that the devices detected 100% of sustained AT episodes and 95.3% of the net AT duration observed on Holter recordings of 40 subjects. Appropriate detection of normal sinus rhythm at termination of AT occurred in 83.7% and 92.1% of episodes in the 2 devices, respectively.[32] Although these studies included subjects with dual-chamber devices, an RR interval-based algorithm used in single-chamber ventricular devices also performed with high sensitivity and specificity in a study based on Holter databases.[33]

The specificity of device AT detection seems to improve with increasing duration and rate of episodes, with a study by Pollak and colleagues[34] finding that only 18% of recorded AHREs episodes of less than 10 seconds confirmed true AT compared with 89% of episodes greater than 5 minutes. Only 18% of AHREs with rates less than 250/min corresponded to true ATs compared with 57% of episodes with rates greater than 250/min. However, not all recorded AHREs represent true ATs, even when selecting for elevated rate and extended duration.[35] In the study by Pollak and colleagues,[34] 12% of the stored episodes with a rate greater than 250/min and duration greater than 5 minutes were still false-positives. In the ASSERT (The Asymptomatic Atrial
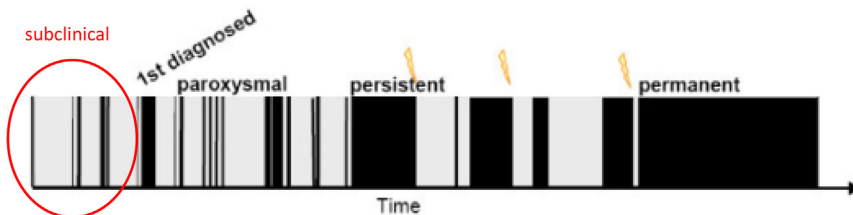
Fig. 1. Progression of AF over time: a typical chaotic pattern of time in AF (*black*) and time in sinus rhythm (*gray*) over time (x-axis). AF progresses from undiagnosed to first diagnosed, paroxysmal, persistent, to permanent. Episodes of AF before the first clinical diagnosis are increasingly recognized in patients with CIEDs. Flashes indicate cardioversions as examples for therapeutic interventions that influence the natural time course of the arrhythmia. (*Adapted from* Kirchhof P, Auricchio A, Bax J, et al. Outcome parameters for trials in atrial fibrillation: recommendations from a consensus conference organized by the German Atrial Fibrillation Competence NETwork and the European Heart Rhythm Association. Europace 2007;9(11):1008; with permission)