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Detection of Atrial Fibrillation After Surgical Ablation: Conventional Versus Continuous Monitoring

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Background. **Current guidelines recommend at least 24-hour Holter monitoring at 6-month intervals to evaluate the recurrence of atrial fibrillation (AF) after surgical ablation. In this prospective multicenter study, conventional intermittent methods of AF monitoring were compared with continuous monitoring using an implantable loop recorder (ILR).**

Methods. **From August 2011 to January 2014, 47 patients receiving surgical treatment for AF at 2 institutions had an ILR placed at the time of operation. Each atrial tachyarrhythmia (ATA) of 2 minutes or more was saved. Patients transmitted ILR recordings bimonthly or after any symptomatic event. Up to 27 minutes of data was stored before files were overwritten. Patients also underwent electrocardiography (ECG) and 24-hour Holter monitoring at 3, 6, and 12 months. ILR compliance was defined as any transmission between 0 and 3 months, 3 and 6 months, or 6 and 12 months. Freedom from ATAs was calculated and compared.**

Results. **ILR compliance at 12 months was 93% compared with ECG and Holter monitoring compliance of 85% and 76%, respectively. ILR devices reported a total of 20,878 ATAs. Of these, 11% of episodes were available for review and 46% were confirmed as AF. Freedom from ATAs was no different between continuous and intermittent monitoring at 1 year. Symptomatic events accounted for 187 episodes; however, only 10% were confirmed as AF.**

Conclusions. **ILR was equivalent at detecting ATAs when compared with Holter monitoring or ECG. However, the high rate of false-positive readings and the limited number of events available for review present barriers to broad implementation of this form of monitoring. Very few symptomatic events were AF on review.**

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Atrial fibrillation (AF) is the most common of all cardiac arrhythmias and accounts for nearly one third of all hospital admissions resulting from heart rhythm irregularities [1]. A recent study predicted that the number of Americans diagnosed with AF will grow to more than 10 million by the year 2050 [2]. AF operations are still underused, and only 40% of patients with a history of AF referred for concomitant cardiac operations currently receive an ablation procedure. A more accurate means of follow-up would allow for better postoperative management strategy, especially regarding decisions to continue antiarrhythmic and anticoagulant medications [3].

Although surgical treatment for AF has been performed for almost 30 years, most of the historical series reported only the recurrence of symptomatic AF or used only intermittent electrocardiographic follow-up. Although it has been demonstrated that episodes of early postoperative atrial arrhythmias usually resolve within the first month after the Cox-Maze (CM) procedure, some do persist [4]. Several studies have demonstrated that complaints of palpitations often result from

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atrial or ventricular premature beats and are not an accurate predictor of recurrent AF [5, 6].

Traditional methods of patient follow-up after treatment for AF have relied on intermittent monitoring. Early studies depended on symptomatic patients' ability to accurately report their rhythm and incorporated only electrocardiographic follow-up [6–9]. Therefore in 2007, an expert panel of electrophysiologists, cardiologists, and cardiac surgeons formed the Heart Rhythm Society Task Force and developed recommendations for catheter and surgical ablation of AF, which included guidelines for posttreatment follow-up and rhythm monitoring [10].

The consensus statement of this expert panel set standards for reporting outcomes to include a minimal assessment of symptomatic AF and a search for asymptomatic AF with prolonged cardiac rhythm monitoring at specified intervals. The basis of follow-up includes a 3-month visit followed by visits every 6 months for 2 years. Patients should receive electrocardiographic monitoring at each visit, and 24-hour Holter monitoring is recommended every 6 months for patients with persistent or long-standing persistent AF. An episode of atrial tachyarrhythmias (ATAs) 30 seconds or more in duration is considered a recurrence.

The optimal duration of prolonged monitoring is controversial. A number of investigators have concluded that continuous monitoring is the best follow-up strategy and is more sensitive at detecting recurrent AF episodes [11–13]. However, there have been few studies in surgical patients, particularly after a Cox-Maze (CM) procedure [14, 15]. Because the CM procedure has a high reported success rate, the utility of more prolonged monitoring periods may not be as helpful as when they are used after less effective interventions.

A continuously recording implantable loop recorder (ILR) is theoretically the best follow-up and should be the most accurate way to define both symptomatic and asymptomatic episodes. The Reveal XT 9529 (Medtronic, Inc, Minneapolis, MN) is a small leadless US Food and Drug Administration–approved ILR that continuously monitors a patient's cardiac rhythm (Fig 1). Recording can be triggered by patient activation as well as automatically. Data collection can be transmitted to health care providers through interrogation at clinic visits as well as electronically through the Medtronic CareLink Network.

The goal of this prospective observational study was to compare traditional means of arrhythmia assessment (ECG and Holter monitoring) with an ILR device.

Patients and Methods

This study was approved by the Washington University School of Medicine Institutional Review Board. Written informed consent and permission for release of information was obtained from each patient before enrollment. All data were entered prospectively into a custom longitudinal database.

Patient Selection

A total of 47 consecutive patients who received an ILR after a surgical ablation procedure were followed between August 2011 and January 2014. Inclusion criteria included patients with AF who were older than 18 years and were scheduled to undergo an elective surgical ablation procedure that included a CM IV lesion set or pulmonary vein isolation. Exclusion criteria included patients with a preoperative permanent pacemaker, a projected life span of 6 months or less, or patients requiring emergent cardiac operations.

Fig 1. Reveal XT implantable loop recording device.

Surgical Procedure

An ILR was placed subcutaneously in the left chest wall after a surgical ablation procedure that included either a stand-alone or concomitant radiofrequency CM IV ablation, left or right atrial ablation, or pulmonary vein isolation. All surgical ablations and device implantations were performed by 1 of 3 experienced AF surgeons at a tertiary university hospital.

Patients were discharged with class I or III antiarrhythmic drugs and warfarin, unless contraindicated; antiarrhythmic agents were discontinued 2 months postoperatively if patients were in normal sinus rhythm. Calcium channel blockers and beta-blockers were not considered antiarrhythmic drugs.

ILR Monitoring and Transmission

The Reveal XT detects ATA episodes based on R-wave variability. The R-R interval is measured and the differences are plotted on a Lorenz plot. Highly irregular R-wave intervals seen during AF produce a Lorenz plot that is very widespread. Using a proprietary algorithm, the device is triggered to record when a widened Lorenz plot is detected.

The ILR stored up to 30 arrhythmia episodes of each type in an episode log. For each ATA episode, the ILR stored an electrogram (EGM) of the first 2 minutes of the episode. Twenty-seven minutes of EGM storage were available for automatically detected episodes. When the available memory was full, the oldest stored EGM recording was overwritten.

When the patient experienced symptoms, the patient prompted the ILR to record a symptomatic episode. Up to 10 patient-activated symptom episodes could be stored in the episode log. Twenty-two and a half minutes of EGM storage were available for the 3 most recent symptom episodes in the episode log. Each symptom episode consisted of 6.5 minutes of electrocardiographic readings before activation and 1 minute after activation.

Transmissions from the patient's home were performed through the Medtronic CareLink remote