Patient Activity Decreases and Mortality Increases After the Onset of Persistent Atrial Fibrillation in Patients With Implantable Cardioverter-Defibrillators

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ABSTRACT

OBJECTIVES The study sought to determine the effect of persistent atrial fibrillation (AF) on device-measured activity and mortality.

BACKGROUND Patients with AF often complain of fatigue, which may be reflected in patient activity. Daily activity can be objectively measured by implanted devices.

METHODS We retrospectively studied patients (n = 266, 88% male, 69 ± 10 years of age) from the deidentified Medtronic CareLink database with persistent AF (≥28 consecutive days with ≥23 h of AF/day), dual-chamber implantable cardioverter-defibrillators (ICDs) capable of monitoring daily activity and AF burden, no AF between months 1 and 6 post-implant, and ≥1 year of data.

RESULTS The first persistent AF episode occurred 980 ± 534 days after implant and lasted a median of 87 days (interquartile range: 49 to 161 days). Average daily activity over a week just prior (baseline) to the first persistent AF episode was compared to each of the 4 weeks during the AF episode and to each of the weeks following termination of the persistent AF episode. Daily activity decreased significantly from the baseline week (135 min/day) compared to each of the 4 consecutive weeks after AF onset (8%, 11%, 14%, and 17% decrease, p < 0.001). Mortality at 4 years was increased in patients with persistent AF compared to a matched group with no persistent AF (20.6% vs. 8.6%, p < 0.01).

CONCLUSIONS Patients with ICDs have a significant reduction in activity following the onset of persistent AF and a significant increase in mortality when compared to a matched group without persistent AF. Objective measures of activity may more accurately reflect the impact of persistent AF on patients' functional status. (J Am Coll Cardiol EP 2016;2:518–23) © 2016 by the American College of Cardiology Foundation.

Atrial fibrillation (AF) is the most frequent cardiac arrhythmia, estimated to affect between 2.7 and 6.1 million adults in the United States, a number that is predicted to double over the next 25 years (1–3). The prevalence of AF in patients with implantable cardioverter-defibrillators (ICD) was reported to be as high as 25% (4).

Dual-chamber ICDs have algorithms that allow AF detection with high accuracy and have data storage capacity that includes: onset of AF, daily measurements of AF burden, and episode durations (5,6).

Symptom-rhythm correlation is the cornerstone of AF patients evaluation and plays a critical role in the decision-making process to determine the eligibility

for sinus rhythm (SR) restoration by cardioversion, antiarrhythmic drugs, or AF ablation (7–10). Engagement in activities of day-to-day life is a reflection of the cardiovascular system status and the impact of cardiovascular disease. Little is known on the impact of AF on patient daily activities. ICDs have accelerometers that can provide an objective measure of patient daily activity (11).

The aim of this study was to determine the impact of persistent AF on activity and mortality in patients with dual-chamber ICDs using the deidentified Discovery Link database.

METHODS

A retrospective analysis was performed using deidentified data from the Discovery Link database (6). Device data was available from centers that had agreed to allow data to be used for research purposes in accordance with Health Insurance Portability and Accountability Act regulations. Patient identification information was removed to protect patient privacy. Stored and programmed data is transferred from Medtronic (Minneapolis, Minnesota) devices to the Medtronic CareLink data server via remote telemetry. The Discovery Link database, a subset of the Medtronic CareLink database, represents all deidentified data obtained from devices implanted in the United States along with a few patient parameters from the device registration database (e.g., age, gender). The following parameters were retrieved from the Discovery Link database: age, gender, date of death, daily-device cumulative AF duration, mean ventricular rate during AF, patient activity, and daily device transthoracic impedance.

STUDY PATIENTS. Persistent AF was defined as AF ≥23 h/day for at least 7 consecutive days (6), which is consistent with the clinical definition recommended by guidelines (7). This study included patients with a persistent AF episode lasting more than 4 weeks. The first persistent AF episode lasting more than 4 weeks after at least 6 months post-implant was considered for analysis. The 6-month period was chosen to exclude any patients who had AF prior to the device implant.

Patients were included in this study if they met the following criteria: 1) persistent AF with duration of ≥28 consecutive days and ≥23 h of AF per day; 2) dual-chamber ICDs capable of monitoring daily activity and AF burden; 3) no AF between months 1 and 6 post-implant; and 4) ≥1 year of data. The flowchart in **Figure 1** illustrates the derivation of the study population.
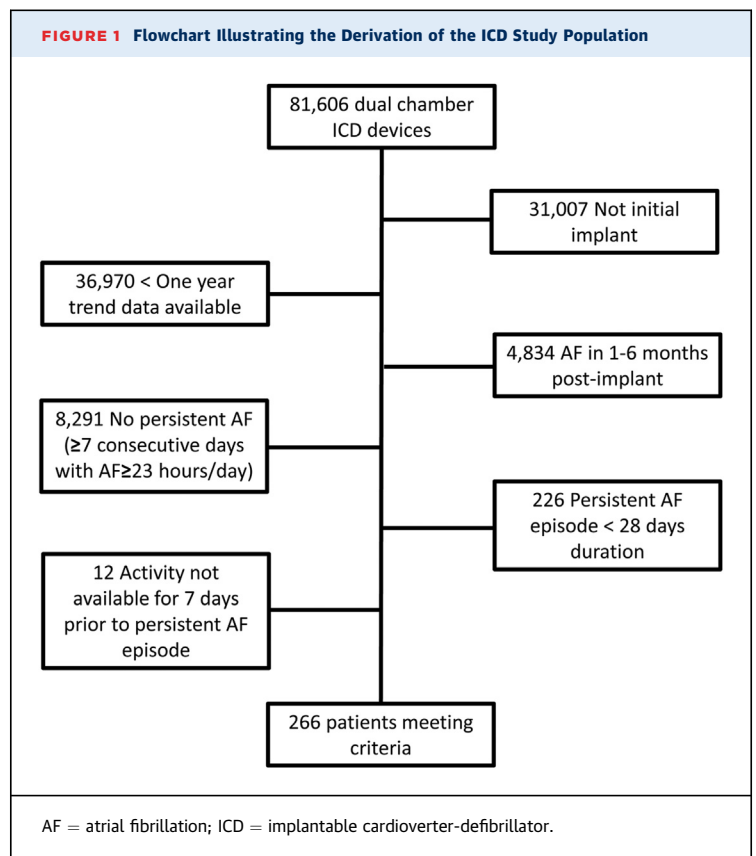
ICD PROGRAMMING AND DIAGNOSTICS. ICD programming and the frequency of data transmission were at the discretion of physicians involved with the care of the respective patients. AF detection and episode quantification were performed using previously validated device algorithms (Online Figure 1A) (5). Device diagnosed AF includes any atrial tachyarrhythmias with an atrio-ventricular ratio >1:1 for >32 ventricular events and a fast median atrial rate (nominally >171 beats/min) as previously described (6).

Modern ICD technology incorporates single-axis accelerometers designed to measure patient activity in daily number of minutes (Online Figure 1B) (11). An active minute corresponds to approximately 70 steps/min (12) and was validated with external 3-axis accelerometers (13).

The average (with standard error) daily activity was calculated over 7 consecutive day windows (Online Figure 1B). The baseline activity was calculated the week prior to the first persistent AF episode and compared to the following 4 weeks during the AF episode. The return to the baseline activity level after the persistent AF episode termination was evaluated as the percent of patients returning to within 10% of

FIGURE 1 Flowchart Illustrating the Derivation of the ICD Study Population

AF = atrial fibrillation; ICD = implantable cardioverter-defibrillator.