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Influence of structural heart disease on characteristics of atrial fibrillation recurrence in patients with dual-chamber pacemakers ☆

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Abstract

Aims: The aim of the study was to prospectively examine the influence of structural heart disease (SHD) and sinus node dysfunction (SND) on the frequency and duration of atrial fibrillation (AF) episodes in patients with implanted pacemakers.

Methods: We examined episodes of AF in 207 patients (93 with SHD; 165 with SND) with known or suspected paroxysmal AF who underwent dual-chamber pacing.

Results: Seventy-one percent of all patients experienced at least one episode of AF during follow-up, with a mean burden of 3.3 ± 6.4 h/d (median, 0.2 hours) and a mean frequency of 11.7 ± 26.0 episodes per day (median, 1.4). The proportion of episodes longer than 6 hours was greater in patients with SHD when compared to patients without SHD. In a logistic regression model adjusted for SND, gender, and the 2-way interactions of SND, sex, and SHD, SHD was a significant factor ($P = .0188$) with the odds ratio of having an episode longer than 6 hours 3.4 times higher for patients with SHD than for patients without SHD. Older patients with SHD had less frequent but longer episodes compared to younger patients. In patients without SHD, there was no comparable age difference. Burden, frequency, and average episode length were not influenced by the presence or absence of SND.

Conclusions: Patients with SHD have longer episodes of AF supporting the concept that SHD influences the underlying substrate to favor perpetuation.

Keywords: Atrial fibrillation; Structural heart disease; Epidemiology; Cardiac pacing

Introduction

Atrial fibrillation (AF) is the most common symptomatic clinical arrhythmia encountered in practice, with an overall incidence of 0.4%. Incidence increases with age.[1,2] Once AF occurs, recurrence is likely in the absence of an identifiable, reversible etiology. Many of these patients will ultimately develop chronic AF, possibly preceded by progressively longer episodes of AF.

Most patients who experience an initial episode of AF will experience a recurrence within 1 year in the absence of antiarrhythmic therapy.[3] These data are based, for the most part, on symptomatic recurrence or the fortuitous detection of asymptomatic AF on follow-up. Because asymptomatic AF episodes are much more frequent than symptomatic episodes,[4,5] this is probably a significant underestimation. Shorter episodes are also more likely to escape detection.[6] Given these limitations, it is not surprising that the influence of structural heart disease (SHD), sinus node dysfunction (SND), or age on the duration of recurrent AF has not been well studied.

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More complete characterization of length and frequency of AF recurrences, even when asymptomatic, is possible using memory-loop recorders modified to autotrigger for AF or in patients who have an implanted pacemaker or defibrillator.[7] The Selection AF*m* Diagnostics Registry was designed to assess the value of atrial-based diagnostics for the chronic management of patients with a history of atrial arrhythmias implanted with a Vitatron Selection AF*m* pacemaker. We used this registry to examine whether the presence of SHD or SND influenced the duration of AF episodes.

Methods

The AF*m* Diagnostics Registry is a multicenter, prospective, postmarket release database. Patients were included in the registry if they met class I or class II indications for dual-chamber pacing,[8] had a known or suspected history of paroxysmal AF, and underwent successful implantation of a dual-chamber Selection AF*m* Model 902 device (Vitatron, Minneapolis, MN) after giving informed consent. Patients were excluded if they had permanent or persistent AF, cardiac surgery within 1 month, AF due to a reversible cause, New York Heart Association functional class IV congestive heart failure, or were believed to be a candidate for an implantable cardioverter-defibrillator.

Patients were enrolled at 42 participating centers (see Appendix A) in the United States. Enrollment began on December 18, 2000. Patients who had a minimum follow-up of 30 days on August 31, 2003, were included in the present analysis. Patients were seen in follow-up at the investigator's discretion but at least twice annually. Case report forms, printouts of all interrogations, and atrial arrhythmia diagnostics were collected initially and at each follow-up visit.

For the purposes of this analysis and in the hopes of defining a population with *atrial dysfunction*, patients were considered to have SHD if they had a history of myocardial infarction, congenital heart disease, cardiomyopathy, congestive heart failure, or significant ventricular enlargement (as defined by the implanting physician). Patients with coronary artery disease in the absence of a myocardial infarction, congestive heart failure, or ventricular enlargement were not considered to have SHD to avoid inclusion of patients with only transient ischemia. Valvular disease was classified as SHD only in the presence of congestive heart failure or ventricular enlargement to minimize inclusion of patients with minor, inconsequential valvular abnormalities. Sinus node dysfunction was defined by the presence of sick sinus syndrome, tachy-brady syndrome, or sinus node dysfunction as the primary indication for pacing in the judgment of the enrolling physician. Patients were considered to have known paroxysmal AF if AF had been previously documented electrocardiographically.

At each interrogation, the following data were available and used for the current analysis: total number of arrhythmias exceeding programmed atrial arrhythmia detection rate (mean and median = 200 beats per minute) during the follow-up period, arrhythmia duration histogram (number of atrial arrhythmias by duration separated into 8 preset classes, from less than 20 seconds to more than 5 days), average number of arrhythmias per day, and total (cumulative) time atrial rate exceeded the arrhythmia detection rate.

For the purpose of these analyses, supraventricular arrhythmias exceeding the programmed arrhythmia detection rate were considered AF. Marker channel analysis of a random 10% sample of recorded episodes was performed by one of the authors (DM) to estimate the proportion of episodes inappropriately classified as AF.

Definitions

Atrial fibrillation burden was defined as the total time atrial rate exceeded the arrhythmia detection rate divided by the observation period, expressed as hours per day.

Atrial fibrillation frequency was defined as the total number of atrial tachyarrhythmia episodes divided by the observation period, expressed as episodes per day.

Average episode length was calculated as the burden divided by atrial tachycardia frequency. Frequency of specific episode length was determined by examining the atrial arrhythmia duration histogram.

Statistics

Data are expressed as mean ± SD and median. Prevalence of AF was compared using the Fisher exact test. A nonparametric test was used to assess characteristics of AF (ie, burden, frequency, average episode length) because they were not normally distributed. If the 2 groups had statistically significant different variances, then a Fligner-Policello test[9] was used; otherwise, the Kruskal-Wallis test was used. A Z test was used to compare the proportion of episodes longer than a given duration. The interaction of sex, SND, and SHD was assessed using logistic regression with 2-way interactions. A P value of less than .05 was considered significant.

Results

Patient characteristics

The study population consisted of 207 patients (99 men) with a mean age of 75 ± 10 years (median, 76.1; range, 42-97 years) that underwent successful pacemaker insertion between December 21, 2000, and November 30, 2001. One hundred sixty-one patients had known paroxysmal AF before implant and 46 had suspected but undocumented paroxysmal AF. Ninety-three patients (45%) had SHD and 165 (80%) had SND (Table 1). Eleven patients had undergone radiofrequency ablation of the A-V node and 10 patients had valvular surgery. Mean follow-up was 319 ± 173 days (range 35-727 days).

Forty-four patients with SHD were receiving antiarrhythmic therapy at enrollment (47%) compared to 31% of patients without SHD ($P = .021$), but there was no significant difference in antiarrhythmic use during follow-up between patients with and without SHD. More patients with SND were on antiarrhythmic therapy at enrollment and at follow-up than those without SND (Table 1).