Principal Atrial Fibrillation Discharges by the New ACC/AHA/ESC Classification

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Background: The American College of Cardiology, American Heart Association, and European Society of Cardiology Board (ACC/AHA/ESC) 2001 guidelines for management of patients with atrial fibrillation (AF) include a new classification system consisting of 4 categories: first-detected episode; recurrent paroxysmal (self-terminating); recurrent persistent (requiring cardioversion); and permanent. The frequency of hospital discharges within these categories has not been reported.

Methods: The new classification system was applied to 135 consecutive hospital discharges with a principal diagnosis of AF.

Results: Classification of AF in these discharged patients included 74 (55%) with first-detected episode; 28 (21%) with recurrent paroxysmal AF; 17 (13%) with recurrent persistent AF; and 16 (12%) with permanent AF. Hypertension (n=48; 35%) was the most common primary cause of AF, followed by alcohol related (n=23; 17%), coronary artery disease (n=20; 15%), and valvular heart disease (n=17; 12%). For the 102 patients with first-detected and recurrent paroxysmal AF, 71 (69%) converted spontaneously to normal sinus rhythm within 48 hours of admission. Of the 48 patients with a discharge diagnosis of AF, 32 (67%) were receiving anticoagulation therapy.

Conclusions: Most hospital discharges with a principal diagnosis of AF represent the first-detected episode. Diverse causes contribute to AF, and to examine them would help direct therapy. Importantly, in our analysis, 69% of those patients with first-detected or recurrent paroxysmal AF converted spontaneously to normal sinus rhythm within 48 hours of admission.

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ATRIAL FIBRILLATION (AF) IS the most common sustained cardiac arrhythmia encountered in clinical practice. The prevalence of AF increases with age, and the number of new cases approximately doubles with each decade of life. First-time hospitalizations for new AF have at least doubled over the past 15 years and are rising fastest in those older than 80 years. Hemodynamic impairment and thromboembolism associated with AF result in considerable mortality and morbidity. As a result, treatment of patients with AF carries important public health implications, and in 2001, the American College of Cardiology, American Heart Association, and European Society of Cardiology Board (ACC/AHA/ESC) published guidelines for its management.

Because AF is encountered in a wide variety of patients, even those without apparent heart or systemic disease, classification has been challenging and often confusing. Traditionally, AF has been classified by cause (eg, valvular vs nonvalvular) or time course (eg, paroxysmal vs permanent). Advocates of various AF classification schemes argue that each subset of patients with AF presents its own unique management issues. Others, however, contend that AF categories are too ambiguous and dependent on the intent of those classifying. In response, the ACC/AHA/ESC designed an AF classification system aimed at simplicity and clinical relevance. The objective of this study was to examine the frequency and demographic characteristics, including the causes of AF, according to the ACC/AHA/ESC classification in patients discharged from a county hospital with a principal diagnosis of AF based on International Classification of Diseases, Ninth Revision (ICD-9) codes.

METHODS

PATIENT POPULATION

The ACC/AHA/ESC classification for AF was applied to a series of consecutive discharges...
with a principal ICD-9 diagnosis of AF from Hennepin County Medical Center, a 330-bed inner-city hospital in downtown Minneapolis, Minn. All patients were identified for the period of January 2000 through October 2001 using hospital discharge codes. We limited our analysis to those with a principal diagnosis of AF (essential reason for hospital admission); those with AF as a secondary diagnosis were excluded. For patients with multiple AF admissions, only the first was included. This retrospective protocol was approved by the institutional review board of Hennepin County Medical Center.

All patients were monitored by telemetry throughout their hospital stay. The attending physician directed treatment strategy on an individual basis. In general, a conservative approach of rate control, anticoagulation, and treatment of the precipitating cause and co-existing conditions was used, with monitoring for up to 48 hours before a decision was made regarding rhythm control and/or discharge anticoagulation therapy. The latter decision was influenced by numerous factors including duration of AF episode and medical history, such as previous documented AF episodes, gastrointestinal bleeding, hemorrhagic stroke, fall risk, chemical dependency, and compliance with prescription medications.

**AF CLASSIFICATIONS**

The 4 AHA/ACC/ESC categories are (1) first-detected episode; (2) recurrent paroxysmal (self-terminating; in general, lasting ≤7 days); (3) recurrent persistent (not self-terminating; requiring chemical and/or electrical cardioversion and usually >7 days duration); and (4) permanent (long-term AF in which cardioversion either failed or was not attempted). Confirmation of the arrhythmia by electrocardiogram,1 classification of discharges according to the AHA/ACC/ESC AF system, and determination of the primary cause of AF were done by physician review.

**PRIMARY CAUSES**

Primary causes of AF included hypertension, alcohol abuse, coronary artery disease, valvular heart disease, dilated cardiomyopathy, hypertrophic cardiomyopathy, hyperthyroidism, and other/unknown. One primary cause was determined for each discharged patient with AF. Patients with multiple possible causes were assigned the one most likely to be responsible for AF. For example, a patient with known coronary artery disease and hypertension was assigned the former as the primary cause when admitted with chest pain. On the other hand, if the same patient was admitted with hypertensive urgency and no chest pain, hypertension was assigned as the primary cause. Hypertension was defined by history or sustained readings of systolic blood pressure greater than 150 mm Hg or diastolic blood pressure greater than 90 mm Hg. Atrial fibrillation was classified as alcohol related if any one of the following were present: (1) acute intoxication on admission; (2) binge drinking within several days of admission; or (3) concurrent alcohol use and a previous AF episode attributed to alcohol abuse within the past 12 months. Coronary artery disease was defined as any of the following: (1) documented history of myocardial infarction; (2) coronary angiography demonstrating at least 1 obstructive lesion greater than 70% in a major epicardial coronary artery; (3) history of coronary revascularization; or (4) evidence of reversible ischemia on noninvasive testing. Valvular heart disease was considered the primary cause if physical findings and echocardiography indicated significant valvular disease. Dilated and hypertrophic cardiomyopathy was diagnosed using standard clinical and echocardiographic criteria. Thyroid disease was based on clinical and/or laboratory evidence.

We considered valvular heart disease, coronary artery disease, dilated cardiomyopathy, or hypertrophic cardiomyopathy as structural heart disease. Other coexisting clinical conditions recorded were hyperlipidemia, peripheral arterial disease, diabetes mellitus, chronic pulmonary disease, chronic kidney disease, and cigarette smoking. Additional rhythm disturbances including atrial flutter, other paroxysmal supraventricular arrhythmias, and ventricular tachycardia were also recorded.

The hospital course was evaluated specifically for whether AF converted spontaneously to normal sinus rhythm or through pharmacologic or electrical cardioversion. We also examined the use of anticoagulation therapy at the time of discharge.

**STATISTICAL ANALYSIS**

Data are presented as the mean±SD for continuous variables and as percentage of cohort for dichotomous variables. The t test was used for determining differences between groups for continuous variables and the χ² test for categorical variables. The frequency of primary causes for the AF categories was also evaluated by the χ² test. All tests were 2-tailed, and statistical significance was defined as P.<.05.

**RESULTS**

Between January 1, 2000, and October 31, 2001, there were 1780 discharges with a diagnosis of AF. A total of 135 patients accounted for 175 discharges with a principal diagnosis of AF. Patient characteristics are given in Table 1. Classification of patients according to the ACC/AHA/ESC guidelines are given in Table 2. Primary causes of AF and coexisting conditions are given in Table 3, with hypertension being the most common primary cause. Other coexisting clinical conditions are also given in Table 3.

The causes of AF in the study patients by ACC/AHA/ESC classification are given in Table 4. Among first-
detected episode and recurrent paroxysmal categories, more than half of the cases were attributed to hypertension or alcohol abuse. In contrast, there were only 2 episodes of alcohol-related AF in the recurrent persistent category and none in the permanent AF category. Valvular heart disease accounted for a greater proportion of cases in those with recurrent persistent or permanent AF (18% and 25%, respectively). Coronary artery disease was a more common primary cause in the 2 recurrent AF categories (25% in paroxysmal; 17% in persistent). Dilated cardiomyopathy accounted for a higher percentage of primary causes in recurrent persistent AF (18%) than in the other categories (4%-11%). Hypertrophic cardiomyopathy accounted for 1% of first-detected episodes. There were 2 cases of hyperthyroidism in the first-detected episode and recurrent persistent AF categories. All 4 of the lone AF cases occurred in the patients’ first-detected episode. Differences in proportions of primary causes within the 4 categories were not statistically significant. The hospital courses of the patients with AF are given in Table 5.

The new ACC/AHA/SEC classification system was designed for simplicity and clinical relevance. An important feature of this new system is recognition of the first-detected episode of AF as a separate category. This potentially represents an improvement over previous classifications that may have forced a patient’s initial AF episode into a specific category, even when there was not enough historical information available to make such a judgment. In this study of hospitalized patients with the principal diagnosis of AF, most represented the first-detected AF episode. As in other reports of patients with “acute or recent onset” AF, most converted spontaneously to normal sinus rhythm when managed conservatively.13,14 Our results extend those observations; approximately three fourths of our patients discharged with a principal diagnosis of AF were either the first-detected episode or recurrent paroxysmal (<7 days) and importantly, most (70%) converted spontaneously to normal sinus rhythm within 48 hours of admission. This observation supports an initial conservative strategy for patients in these 2 categories, particularly the first-detected episode. The use of anticoagulation therapy was twice as high at discharge for those with AF compared with those with normal sinus rhythm. The rate of anticoagulation therapy may seem less than expected, but the decision regarding anticoagulation was made while taking into consideration patient characteristics such as medical compliance, chemical abuse, fall risk, and duration of the first AF episode.

Structural heart disease was more common in the patients with recurrent persistent and permanent AF. This is not surprising because AF duration or burden and structural heart disease may be more likely to result in atrial myocardial and electric substrate changes leading to a more persistent and/or permanent form of AF.

Not surprisingly, hypertension was the most common primary cause of AF and coexisting condition in our study. Two other inpatient studies reported a similar proportion of hypertension.15,16 There was a considerably higher proportion of patients with coronary artery disease in the study by Frykman et al.,17 but that study’s population was older and had a higher percentage of chronic AF. In the study by Barriales Alvarez et al.,16 alcohol abuse was not offered as a primary cause but was found to be an independent risk factor for AF in 20% of patients. In contrast, 2 large studies found no significant relationship of alcohol use to the development of AF in age-adjusted models.17,18 Different classification methods make comparison of these studies with ours difficult and emphasize the importance of standard classification nomenclature. The distribution seen in our study would undoubtedly be different if patients with a secondary diagnosis of AF were included. Further differences would be expected if outpatients were studied.

Patients in the first-detected episode and recurrent paroxysmal AF categories were nearly identical with respect to proportion with hypertension and alcohol-related AF and duration of AF episode (≤48 hours). Not surprisingly, the primary cause distributions were different from those found in the recurrent persistent and permanent AF categories. While hypertension was still the most common cause in the recurrent persistent and permanent AF categories, there was a tendency toward a higher proportion of structural heart disease in these groups than in the other AF categories. Also, the mean age was higher in permanent AF. These observations sup-

<table>
<thead>
<tr>
<th>Cause/Condition</th>
<th>Discharges, No. (%)</th>
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<tbody>
<tr>
<td>Hypertension</td>
<td>48 (35)</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>23 (17)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>20 (15)</td>
</tr>
<tr>
<td>Dilated cardiomyopathy</td>
<td>17 (12)</td>
</tr>
<tr>
<td>Hypertrophic cardiomyopathy</td>
<td>13 (10)</td>
</tr>
<tr>
<td>Hypertrophic cardiomyopathy</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Ventricular tachycardia</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Wolff-Parkinson-White syndrome</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Atrial flutter</td>
<td>7 (5)</td>
</tr>
<tr>
<td>Other supraventricular tachycardia</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>1879</td>
</tr>
</tbody>
</table>

*Of these 9 episodes that could not be accounted for by any of the categories, 4 met the criteria for lone atrial fibrillation (absence of hypertension or structural heart disease).
port the notion that there is progression through the 4 AF classifications, leading to a higher proportion of older patients with structural heart disease in the permanent category.

Our study has several important limitations. First, this was a retrospective study limited to discharges with a principal diagnosis of AF, determined by hospital ICD-9 coders. Patients presenting with their first-detected AF episode were more likely to be admitted for that reason, thereby skewing our sample from the entire AF population. Patients with longer-duration AF were perhaps less likely to be admitted primarily for an established arrhythmia. More likely, if they were admitted, it was often under another diagnosis with AF as a secondary diagnosis. This may explain the small number of patients with recurrent persistent and permanent AF in our study.

Second, our patient population may be different from other studies. In general, our county hospital population tends to be younger, more ethnically diverse, and have higher rates of drug and alcohol abuse. Indeed, compared with several larger studies, the proportion of AF related to alcohol in our cohort was considerably higher.

Finally, we attempted to assign 1 primary cause for each patient. This was often difficult, especially for patients who had multiple possible causes for AF. However, we also report the frequency of coexisting clinical conditions, and it is similar to other AF populations. Despite these limitations, we believe it is useful to examine the primary cause of AF to better direct specific treatment and/or prevention strategies.

The new ACC/AHA/ESC classification for AF was designed with goals of simplicity and clinical relevance. We applied this classification scheme to consecutive hospitalized patients with a principal diagnosis of AF. The majority (55%) of patients with AF in our study represented the first-detected episode. Approximately three fourths of all AF discharges were first-detected or recurrent paroxysmal AF, and two thirds of these spontaneously converted to normal sinus rhythm within 48 hours of admission. These observations support an initial clinical strategy of observation, rate control, and treatment of the precipitating cause.

We noted diverse primary causes of AF with variable distributions across the AF classifications. Hypertension was the most common primary cause or coexisting condition in all categories. Structural heart disease was more common in patients with recurrent persistent and permanent AF. Alcohol abuse was an important cause of shorter-duration AF, especially in younger patients without structural heart disease, and may be an important,
modifiable cause of AF. In the future, we believe studies of AF should be reported using the ACC/AHA/ESC classification. This system provides standardization and may effectively guide treatment strategies.

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REFERENCES