The Alternation between Atrial Flutter and Atrial Fibrillation*

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Atrial fibrillation and atrial flutter share a common reentrant mechanism. However, the relationship between these arrhythmias has not been systematically studied to date. To evaluate the degree to which these arrhythmias may alternate, consecutive Holter monitor recordings which showed fibrillation or flutter in 96 patients were reviewed. One half of the patients were studied after open-heart surgery and the other half for varying indications. One quarter of the patients had atrial flutter in addition to fibrillation, and this alternation with flutter was significantly associated with the use of a type 1A antiarrhythmic drug (p = 0.007), but not with the use of digoxin or beta blockers (p = NS for both). Furthermore, this alternation with flutter was more common in the postoperative group (p = 0.01). A history of embolization was less common in patients who were in the postoperative group (p = 0.003) and patients who had flutter in addition to fibrillation (p = 0.05).

(Chest 1992; 101:34-36)

Atrial fibrillation is a common cardiac arrhythmia. It is seen in 2 to 4 percent of patients greater than 60 years of age,1,2 0.4 percent of the general adult population,3 and 7 to 10 percent of patients with myocardial infarction.4 It is especially common in patients with mitral stenosis who have had emboli (present in 90 percent).3 Atrial flutter has long been identified as an arrhythmia separate from fibrillation,4 but it has been believed that the two arrhythmias share a similar macro reentrant mechanism (fibrillation being due to random reentry and flutter being due to nonrandom localized reentry). However, the degree to which these arrhythmias coexist or alternate has not been systematically studied thus far. In order to determine the relationship between these arrhythmias, consecutive Holter monitor recordings which showed atrial fibrillation or flutter or both in 96 patients were reviewed.

METHODS

Over a three-month period, a total of 992 consecutive patients underwent ambulatory ECG (Holter) recordings in our laboratory. Of these, 96 patients (10 percent) had recordings which showed atrial fibrillation and/or atrial flutter with or without additional sinus rhythm. The two arrhythmias were defined according to Allessie and Bonke,5 with atrial fibrillation showing "chaotic and uncoordinated" atrial activity with "completely irregular atrial activation . . . in the form of small waves that constantly vary in amplitude and configuration." Atrial flutter showed "rapid, highly regular rhythm of the atria (200 to 350 beats/minute) . . . with regular biphasic oscillations (F waves) of uniform shape." In addition, the ventricular response in fibrillation was defined as irregularly irregular while in flutter the R-R intervals were defined as appearing in regular or fixed multiples.

Of the 96 patients, half (48) were studied during hospitalization following open-heart surgery and were designated as group A. The other 48 patients, group B, were studied for various other clinical indications. The two groups were analyzed for the presence of valve disease, history of embolic phenomena and treatment with type 1A antiarrhythmic drugs (quinidine, procainamide or disopyramide), digoxin and beta blockers. No patient was on a type 1C drug. There were six differing patterns of arrhythmia as follows:

1. AF: Fixed atrial fibrillation, present on the entire recording.
2. PAF: Paroxysmal atrial fibrillation, with fibrillation alternating with sinus rhythm.
3. AFF: Fixed atrial flutter, present on the entire recording.
4. PAFl: Paroxysmal atrial flutter, with flutter alternating with sinus rhythm.
5. Comb: Combined fibrillation and flutter, with alternation between the two rhythms and no sinus rhythm present.
6. Pbrox Comb: Paroxysmal combined fibrillation and flutter, with alternations between fibrillation, flutter and sinus rhythm.

Groups A and B (postoperative and nonpostoperative) were compared statistically by the chi square test (age was compared with the use of a t test), and a p value of ≤0.05 was considered to be statistically significant.

High-fidelity ECG recordings were done on a reel-to-reel tape recorder using a two-lead system (V1 and V5) and were scanned on a Del Mar Avionics Trendsetter. All arrhythmias were reviewed and classified by at least two of the authors including at least one cardiologist. The number and duration of periods of atrial fibrillation and flutter were noted. Clinical information was obtained from the patient's physician and from the hospital chart.

RESULTS

The entire study group consisted of 96 patients, 60 men and 36 women. Their ages ranged from 14 to 90 years old, with an average age of 67 ± 11 years. There were 47 patients with atherosclerotic heart disease, 21 with mitral valve disease, 17 with aortic valve disease, three with congenital heart disease, two each with cardiomyopathy, endocarditis, sick sinus syndrome and hypertension, and one with cardiac amyloidosis. There were 12 patients with atrial fibrillation and no demonstrable heart disease.
Arrhythmia Classification

Most of the patients (83, 86 percent) had atrial fibrillation, either alone or with sinus rhythm or flutter, or both. The six differing patterns of arrhythmia occurred as follows:

1. AF: 42 patients (44 percent).
2. PAF: 17 patients (18 percent).
3. AFI: 6 patients (6 percent).
4. PAF: 7 patients (7 percent).
5. Comb: 4 patients (4 percent).
6. Parox Comb: 20 patients (21 percent).

Postoperative vs Nonpostoperative (Group A vs B):
The groups were of equal size (48 patients each), and the postoperative patients were somewhat younger (64.6 vs 69.7 years old, p = 0.03 [Table 1]). Postoperative patients (group A) were more likely to have valve disease (p = 0.02), and they were more likely to have the following types of arrhythmias: PAF (p = 0.02) and Parox Comb (p = 0.01). Statistically there was a trend to have any type of atrial flutter in this group also (p = 0.06). The nonpostoperative patients in group B were more likely to have fixed atrial fibrillation (p = 0.0002) and a history of embolization (p = 0.003). There was no statistically different incidence of the other types of arrhythmia or of treatment with a type 1A antiarrhythmic drug, digoxin or beta blocker between groups A and B.

Alternating Flutter and Fibrillation

There were 24 patients with alternation between fibrillation and flutter, which included 20 patients with Parox Comb (some sinus rhythm) and four with Comb (no sinus rhythm). Of these 24, 17 (71 percent) were in group A (postoperative) and seven in group B. There were 14 patients with atherosclerotic heart disease, seven with aortic valve disease, three with mitral valve disease, two without associated heart disease and one with cardiomyopathy (three had more than one cardiac disease). The duration of atrial flutter in patients with alternating flutter and fibrillation (with or without sinus rhythm) averaged 255 min (range, 1 to 1,369 min) and these patients spent an average of 19 percent of the time in flutter (range, 0.1 to 99.9 percent). In contrast, the duration of atrial flutter in the patients with PAF was almost twice as long, averaging 497 min (range, 45 to 1,406 min), and these patients spent an average of nearly twice as much time (35 percent) in flutter (range, 3 to 89 percent). The number of episodes of flutter per patient was similar in those with combined flutter and fibrillation and those with just PAF: patients with PAF had an average of three episodes of flutter on their ambulatory recording (range, 1 to 15, with five patients having only one); patients with alternating flutter and fibrillation (with or without sinus rhythm) had an average of five episodes of flutter (range, 1 to 45, with 12 patients having only one).

Drug Therapy

A type IA antiarrhythmic agent was in use at the time of the recording in 33 of 96 patients (34 percent). Of note, 13 of the 24 patients (54 percent) in the Comb and Parox Comb groups were on a type IA agent during the recording. Only 14 of 59 patients (24 percent) who had fibrillation and no flutter (AF and PAF) were on a type IA antiarrhythmic drug. This difference was statistically significant (p = 0.007). There were no significant differences between patients with Comb and Parox Comb vs patients with AF and PAF with respect to the use of digoxin and beta blockers (p = NS for both). Thus, in patients with atrial fibrillation, the use of a type IA drug was significantly associated with alternation with atrial flutter. However, the type IA drugs may have been prescribed because of rhythms which are paroxysmal and therefore presumably more likely to be chemically cardiovertable, and paroxysmal arrhythmias may have more of a propensity to alternate. Therefore the drugs may not be responsible for the alternation.

There was no significant difference in the use of a type 1A drug between postoperative patients (group A) and nonpostoperative patients (group B), 18 vs 15 patients, nor was there any difference between these two groups in the use of digoxin (33 vs 27 patients) or beta blockers (15 vs 13 patients [p = NS for both]).

History of Embolization

There was a history of stroke or peripheral embolization in 17 of 96 patients (18 percent). This high incidence could be due to selection bias, since patients with emboli may have been referred for Holter monitoring.

Table 1—Clinical and ECG Data

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>p Value</th>
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<tbody>
<tr>
<td>N</td>
<td>48</td>
<td>48</td>
<td>NS</td>
</tr>
<tr>
<td>Age</td>
<td>64.6</td>
<td>69.7</td>
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<td>AF (42)</td>
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<td>30</td>
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<tr>
<td>PAF (17)</td>
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<td>4</td>
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<tr>
<td>AFI (6)</td>
<td>2</td>
<td>4</td>
<td>NS</td>
</tr>
<tr>
<td>PAF (7)</td>
<td>4</td>
<td>3</td>
<td>NS</td>
</tr>
<tr>
<td>Comb (4)</td>
<td>2</td>
<td>2</td>
<td>NS</td>
</tr>
<tr>
<td>Parox Comb (20)</td>
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<td>0.01</td>
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<tr>
<td>Any AF (83)</td>
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<td>41</td>
<td>NS</td>
</tr>
<tr>
<td>Any AFI (37)</td>
<td>23</td>
<td>14</td>
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<tr>
<td>Emboli (17)</td>
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</tr>
<tr>
<td>Type IA Rx (33)</td>
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<td>NS</td>
</tr>
<tr>
<td>Digoxin Rx (60)</td>
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<td>NS</td>
</tr>
<tr>
<td>β-Blocker (28)</td>
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<td>13</td>
<td>NS</td>
</tr>
<tr>
<td>Valve dis (35)</td>
<td>23</td>
<td>12</td>
<td>0.02</td>
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</table>

AF = atrial fibrillation; AFI = atrial flutter; COMB = combined atrial fibrillation and flutter, no sinus rhythm; PAF = paroxysmal atrial fibrillation; PAF = paroxysmal atrial flutter; Parox Comb = combined atrial fibrillation, atrial flutter, and sinus rhythm.
**Emboli and Arrhythmias**

Of these, 17, 11 were in the AF group, three in the PAF group and three in the Parox Comb group (only one of whom was in the postoperative group A). A history of embolization was statistically more likely to be present in patients with fibrillation alone (without atrial flutter \(p = 0.05\)). There were 14 of the 17 patients with a history of embolization in group B, and only three of 17 in the postoperative group A. This relationship was also statistically significant \(p = 0.003\).

**Emboli and Cardiac Diagnosis**

There was a high incidence of history of embolization in the patients with AF and no demonstrable heart disease, 6 of 12 (50 percent), which also may be due to selection bias. Of the 36 patients with valve disease, only 3 (8 percent) had a history of embolization. This represented 18 percent of the 17 patients with embolization. All three of them had mitral valve disease (no patient with aortic valve disease had a history of embolization).

**Discussion**

Atrial fibrillation has been believed to be due to multiple reentrant circuits within the atrial myocardium. Similarly, atrial flutter is thought to be due to reentry, and Olshansky et al. have demonstrated reentry and an area of slow conduction in human atrial flutter. It is therefore not surprising that the two rhythms may occur in the same patients, and in fact the presence of atrial fibrillation, atrial flutter and sinus rhythm in differing parts of the atria at the same time has been shown in a patient whose surface ECG showed atrial flutter. Murdock et al. recently have treated 82 patients who had atrial fibrillation with a type IC agent, propafenone. In 13 of their patients (16 percent) atrial flutter as well as fibrillation had been documented, and atrial flutter occurred in 14 patients during propafenone therapy (17 percent). Since they did not have any patients who were not given propafenone (no control group), they were not sure whether the flutter occurred because of the effects of the drug or whether the flutter was coincidental, since patients with atrial fibrillation also may develop flutter independent of therapy. We have shown that atrial flutter is common in patients who also have atrial fibrillation, and it was seen in one quarter of such patients in our study.

The patients in the postoperative group A had a significantly higher incidence of PAF and a significantly lower incidence of AF than the patients in group B. In addition, the postoperative patients had a significantly higher incidence of Parox Comb. The paroxysmal nature of the arrhythmias in the postoperative group is not surprising in view of the acute inflammatory and hemodynamic changes which occur in such patients.

With respect to a history of embolization, this was uncommon in the patients with postoperative arrhythmias. This probably also reflects the acute and transient nature of the arrhythmias in the postoperative setting. Furthermore, a history of embolization was more common in patients who had atrial fibrillation without flutter than in those who experienced alternation between fibrillation and flutter. This may in part be due to the effective atrial contractions which occur during flutter and not during fibrillation, which may make stagnant flow and clot formation less likely. The high incidence of embolization in the patients with AF and no demonstrable heart disease (50 percent) probably reflects referrals from neurologists and rehabilitation specialists.

**Conclusion**

Patients with atrial fibrillation commonly have periods of atrial flutter as well. This alternation with atrial flutter is associated with the use of type IA antiarrhythmic drugs, but not with the use of digoxin or beta blockers. However, this does not prove that type IA drugs caused the alternation, since these drugs may have been prescribed because of the nature of the patients' arrhythmias, while digoxin and beta blockers may have been prescribed for more stable rhythms. Alternation with flutter is more common in patients following open-heart surgery. A history of embolization is relatively uncommon in patients with postoperative arrhythmias, which are more likely to be paroxysmal. Embolization also is relatively uncommon in patients with flutter in addition to their atrial fibrillation.

**References**