Adequacy of Preoperative Digitalis Therapy in Controlling Ventricular Rate in Postoperative Atrial Fibrillation

By Arthur Selzer, M.D., and Robert M. Walter, M.D.

IN RECENT YEARS there has been a re-awakening of interest in prophylactic administration of digitalis, particularly prior to cardiovascular operations.1-5 Such use of digitalis aims at improvement of cardiac performance at the time of stress and at reduction of ventricular rate in cases in which atrial fibrillation might be anticipated. The purpose of this communication is to assess the preoperative administration of digitalis in adequately controlling ventricular rate in postoperative atrial fibrillation.

Methods

This study was based on a series of 53 unselected patients with mitral valve disease in whom either closed mitral valvotomy (44 patients) or an open-heart operation (nine patients) was performed. All patients were in sinus rhythm at the time of operation and developed atrial fibrillation in the immediate postoperative period. The change of policy in this unit concerning the use of digitalis6 made it possible to compare patients with and without preoperative administration of digitalis. Until 1962 all patients undergoing mitral valve operation received digitalis before and after the operation; after that date no digitalis was administered to patients who had not previously had digitalis; those who were maintained on digitalis in the past had the drug discontinued 3 or 4 days prior to the operation. In none of the patients was digitalis administered after the operation unless specific indications for the drug (heart failure or atrial fibrillation) developed. The patients thus fell into three categories: group A, patients who never had digitalis prior to the onset of atrial fibrillation; group B, those who had digitalis in the past but several doses of the drug were omitted prior to the onset of the arrhythmia; and group C, patients maintained on conventional dosages of digitalis.

All patients had electrocardiograms taken prior to the operation, and daily electrocardiographic strips were recorded after the procedure. If any change was clinically noted, an electrocardiogram was immediately taken. Thus, cardiac rates and the rhythm were determined from electrocardiographic tracings. If after the onset of atrial fibrillation ventricular rate was found to be faster than the last recorded rate in sinus rhythm, digitalis was administered either by intravenous or oral routes until rates slowed to control levels. This was accomplished within no more than 24 hours. In a few patients sinus rhythm returned after small doses of digitalis.

Results

The series consisted of 53 patients, 12 men and 41 women. Twelve patients never had digitalis (group A); 18 belonged to the intermediate group B, in whom use of digitalis was discontinued prior to the operation; 23 were taking conventional dosages of digitalis at the time of onset of atrial fibrillation (group C).

Group C consisted of four patients who underwent prophylactic administration of digitalis by means of 1.5 to 3.0 mg of digoxin; 19 patients were on maintenance dosages of digitalis upon entry to the hospital and were continued on the same doses; 10 patients were taking digitalis leaf (eight received 0.1 g daily, one, 0.15 g daily; and one, 0.2 g daily); five patients were taking digoxin (three, 0.25 mg daily and two, 0.5 mg daily) and four were on digitoxin (one, 0.1 mg daily and three, 0.2 mg daily).

Patients in group B were on a maintenance dose of digitalis upon admission to the hospital; the distribution and dosages of digitalis preparations were similar to those in group C.

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Administration of the drug was discontinued 3 or 4 days prior to the operation; consequently, the time between the last dose of digitalis and the onset of atrial fibrillation varied from 3 to 10 days with the mean interval for the group of 5.2 days.

A comparison of the interval between the operation and the onset of atrial fibrillation was made in patients in the three groups. The interval for the entire series varied between 1 and 10 days, the frequency of the onset of the arrhythmia being as follows: first day, 12%; second day, 47%; third day, 14%; fourth day, 19%; fifth day or later, 8%. No difference was detected between the three groups: the commonest interval between the operation and onset of atrial fibrillation was 2 days, the incidence of the onset on the second day being 50% in group A, 45% in group B, and 48% in group C.

The type of atrial activity in atrial fibrillation in patients with and without previous administration of digitalis was compared by measuring the average rate of F-waves in patients of group A and C. In both groups F-wave rates varied between 320 and 480 per minute; the mean rates were 425 per minute in group A and 420 in group C, indicating that rates were comparable.

The comparison of ventricular rates recorded at the time of the last observation prior to the onset of atrial fibrillation and that recorded immediately after the onset of the arrhythmia was presented in table 1. The statistical significance of the differences between the three groups is less than 0.001. In addition, the difference between the groups was approached by comparing the increase of heart rate in each case between the last recorded rate in sinus rhythm and that in atrial fibrillation. The observed mean differences between the two mechanisms were: 74 (SD, 27.7); 50 (SD, 17.0), and 22 (SD, 16.7). This difference was also found to be significant at the level of less than 0.001.

Table 2 shows the comparison of the three groups in regard to the amount of digitalis needed in the first 24 hours after the onset of atrial fibrillation to bring the ventricular rate roughly to the pre-fibrillation level. Inasmuch as several digitalis preparations were used in patients, equivalent units were accepted, as indicated in the table. A significant digitalis deficit existed in at least half of the patients

### Table 1

Comparison of Cardiac Rates Before and After the Onset of Atrial Fibrillation

<table>
<thead>
<tr>
<th>Group A; no digitalis</th>
<th>Cases</th>
<th>Heart rate in sinus rhythm</th>
<th>Heart rate in atrial fibrillation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>Mean</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>71 - 100</td>
<td>120 - 200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SDS</td>
<td>25.7</td>
</tr>
<tr>
<td>Group B; incompletely</td>
<td>18</td>
<td>Mean</td>
<td>87</td>
</tr>
<tr>
<td>digitalized</td>
<td></td>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 - 104</td>
<td>115 - 174</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SDS</td>
<td>17.6</td>
</tr>
<tr>
<td>Group C; fully</td>
<td>23</td>
<td>Mean</td>
<td>98</td>
</tr>
<tr>
<td>digitalized</td>
<td></td>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>76 - 150</td>
<td>80 - 170</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SDS</td>
<td>25.9</td>
</tr>
</tbody>
</table>

sd, standard deviation.

### Table 2

Amount of Digitalis Used in the First 24 Hours to Control Cardiac Rate After Onset of Atrial Fibrillation in Groups A, B, and C

<table>
<thead>
<tr>
<th>Group A; no digitalis</th>
<th>Case</th>
<th>Units of a digitalis preparation*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5</td>
</tr>
<tr>
<td>Group B; incompletely</td>
<td>7</td>
<td>Mean</td>
</tr>
<tr>
<td>digitalized</td>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.0</td>
</tr>
<tr>
<td>Group C; fully</td>
<td>12</td>
<td>Mean</td>
</tr>
<tr>
<td>digitalized</td>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.8</td>
</tr>
</tbody>
</table>

*1 Unit: 0.1 g of digitalis, 0.1 mg of digitoxin, 0.25 mg of digoxin, or 0.5 mg of deslanoside.
with continuous digitalis intake and half of those needed the full therapeutic dose of the drug in order to control ventricular rate.

Discussion

The study was based on the observation that in patients with mitral valvular disease who are in sinus rhythm at the time of mitral valvotomy atrial fibrillation develops at a rate of 35% within the first few days after the operation. Findings of the study indicate clearly that preoperative use of digitalis—both prophylactic administration of the drug and chronic maintenance therapy—are only partly successful in controlling ventricular rate during atrial fibrillation. It is shown that in these patients only half showed ventricular rates suggesting adequate digitalis effect. Half of the patients with excessive ventricular rates (one quarter of group C) exhibit rates as fast as patients who never received digitalis and needed full doses of the drug to bring their ventricular rates to levels comparable to those before the onset of the arrhythmia.

Control of ventricular rates in atrial fibrillation is the most widely used index—probably the only reliable one—of adequacy of digitalis dosage. This study indicates that the generally used dosages were adequate only in half of the cases. Assuming that this represents an average situation existing in patients who are given digitalis while in sinus rhythm, these results point out the inadequacy of judging digitalis needs in such patients. Digitalis given to patients for treatment of existing atrial fibrillation can be titrated in each individual case. Its use in patients who are in sinus rhythm—whether for therapeutic or prophylactic purposes—seems to pose a dilemma for the clinician. He can use average doses, in which case the full therapeutic effect of the drug is likely to be accomplished only in about half of his patients. On the other hand, he can use higher than average dosages in order to increase the proportion of patients in whom the full therapeutic effect of digitalis is achieved, but then he is likely to produce toxicity in some patients. Until some clinical means of assessing the adequacy of digitalis effect in patients in sinus rhythm is found, one has to be aware of the empirical nature of the administration of this drug.

Summary and Conclusions

In 53 unselected patients with mitral valve disease who underwent mitral valve surgery and developed atrial fibrillation in the immediate postoperative period, the ventricular rates were measured immediately before and after the onset of atrial fibrillation. Patients were divided into three groups: A—those who received no digitalis at all; B—those who were maintained on digitalis prior to the operation and in whom treatment with digitalis was discontinued several days before the onset of the arrhythmia; and C—those who were maintained on conventional doses of digitalis up to the onset of the arrhythmia. Results of the study indicated that the mean ventricular rates at the time of the onset of atrial fibrillation were 163 beats per minute in group A, 138 in group B, and 121 in group C. Differences among the three groups were statistically significant at the 0.001 level. However, it was shown that the mean ventricular rate in patients receiving digitalis maintenance therapy was still significantly higher than control rates in sinus rhythm. Furthermore, in half of the patients in group C inadequate control of ventricular rates was observed during atrial fibrillation. In half of this subgroup (one quarter of group C) excessive ventricular rates and high requirements for additional digitalis needed to bring ventricular rates under control suggested a virtually nonexistent digitalis effect.

Acknowledgment

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References


Psychotherapy for Cardiac Pain

Henry James had suffered from a pain, and desired to consult Mackenzie about it. When he entered the doctor’s room in Harley Street, he was met with the question:
“What was it really that the children saw outside the window which so greatly terrified them?”

The reference was, of course, to a story by James himself. James raised his hands, and in that voice of his which, had it not been sincere, must have been almost incredibly pompous, replied:
“My dear Sir James, do you not know that the whole basis of terror is a mystery? The children were afraid, because they did not know what it was they were looking at. Why, then, should I tell the reader what they were looking at?”

Mackenzie nodded, and proceeded to examine his patient. Then he asked:
“What are you afraid of?”
“I don’t know. . . .”
“Like the children in the story.”

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