**Atrial Tachycardia with Block Treated with Digitalis**

By William L. Morgan, M.D., and Gerald M. Breneman, M.D.

Atrial tachycardia with atrioventricular block was first described by Sir Thomas Lewis in 1909. In recent years, Lown, Levine, and co-workers have emphasized the importance of digitalis intoxication as a cause of this arrhythmia. Other authors have also supported this concept.

Two large series describing the arrhythmia were published in 1943. Barker and co-workers found that digitalis was beneficial in 14 of 35 cases, whereas Decherd et al. concluded that the drug was a probable cause of the arrhythmia in 25 of 40 additional patients. This incidence of excessive digitalis (62½ per cent in 40 patients) causing atrial tachycardia with block is similar to Lown and Levine's experience of 73 per cent in 112 episodes. In contrast, other workers recently have found digitalis responsible only 16 times in 40 episodes.

The present report describes 15 patients seen in a period of 1 year who had atrial tachycardia with block. In nine of these cases the arrhythmia was not due to excessive digitalis. These patients illustrate the fact that continued digitalis may be beneficial in controlling congestive heart failure or preventing a rapid ventricular rate.

**Material and Method**

From January 1960 to January 1961, 18,884 electrocardiograms were taken at the Henry Ford Hospital. Fifteen cases of atrial tachycardia with block were found that fit the criteria of Lown and Levine: (1) an atrial rate of 150 to 250 per minute, (2) isoelectric intervals between P waves in all leads, and (3) atrioventricular block beyond a simple prolongation of the P-R interval. Where all leads were not present or where quinidine had slowed the atrial rate in probable atrial flutter, the case was discarded. The incidence of this arrhythmia was 1 in 1,259 electrocardiograms compared to 1 in 455 in Lown and Levine's series. This discrepancy is not completely understood and may in part be explained as follows: 1. The Henry Ford Hospital has 1,000 beds and a large outpatient department, averaging over 2,000 patients a day. Since 42 per cent of the total tracings were from the outpatient department, these electrocardiograms would not reflect the serious disorders of a series with a higher percentage of tracings from sick hospitalized patients. 2. Also, the Henry Ford Hospital inpatient case material may differ from the Peter Bent Brigham Hospital with fewer electrolyte and metabolic disturbances. 3. Finally, the possibility exists that cases with this arrhythmia may have been missed. Every electrocardiogram taken during this year, however, was reviewed by one of the authors specifically looking for the arrhythmia. It is doubtful that many patients were missed and certainly there should have been no bias in selecting cases not intoxicated by digitalis.

The nine patients having atrial tachycardia with block not due to digitalis are listed in table 1 and the individual case reports follow below. The six patients with digitalis intoxication are found in table 2.

**Case Reports**

**Case 1**

M.L. (HFH no. 06 82 00) was a 55-year-old woman with no clinical evidence of heart disease, who gave a history of attacks of rapid heart action since the age of 11. At age 18, this was proved by electrocardiogram to be atrial tachycardia, rate 200 per minute, with 1:1 conduction. Since January 1956 she has been followed at this hospital with existing atrial tachycardia with block. She had been seen at another hospital in December 1955 and had been given digitalis. Her typical electrocardiogram in the past 5 years has shown broad notched P waves at a rate of 136 to 175, usually with 3:2 Wenckebach conduction (fig. 1A). Rarely 1:1 conduction occurred at lower atrial rates or 2:1 at higher rates. On three occasions other rhythms have been demonstrated. Sinus rhythm was present by electrocardiogram in April 1957 for 3 months and in May 1960 for 4 days. Atrial fibrillation was recorded in September 1960 and terminated within 2 weeks. On each of these three occasions atrial tachycardia with block occurred and has persisted to the present time.

The patient has been on a maintenance dose of...
<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age</th>
<th>Prior cardiac treatment</th>
<th>Atrial rate</th>
<th>A-V conduction</th>
<th>Ventricular rate</th>
<th>Duration</th>
<th>Treatment of arrhythmia</th>
<th>Prior rhythm</th>
<th>Subsequent rhythm</th>
<th>Clinical diagnosis, living or dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. M.L.</td>
<td>F</td>
<td>55</td>
<td>Maintenance digitalis</td>
<td>136–175</td>
<td>3:1</td>
<td>80–175</td>
<td>5 years</td>
<td>Digitalis stopped without effect, maintenance digitalis continued</td>
<td>Atrial tachycardia</td>
<td>Atrial tachycardia with block</td>
<td>No heart disease, severe psychoneurosis, living</td>
</tr>
<tr>
<td>2. P.D.</td>
<td>M</td>
<td>64</td>
<td>None</td>
<td>200–214</td>
<td>Variable</td>
<td>60–100</td>
<td>Persisting at 3 months</td>
<td>Subsequent digitalization</td>
<td>?</td>
<td>Atrial tachycardia with block</td>
<td>Rheumatic heart disease, living</td>
</tr>
<tr>
<td>3. V.K.</td>
<td>F</td>
<td>69</td>
<td>None</td>
<td>190</td>
<td>Variable</td>
<td>130</td>
<td>2 days</td>
<td>Subsequent digitalization</td>
<td>?</td>
<td>Sinus rhythm</td>
<td>Coronary artery disease, strangulated femoral hernia, living</td>
</tr>
<tr>
<td>4. S.G.</td>
<td>F</td>
<td>56</td>
<td>Maintenance digitalis, quinidine</td>
<td>200</td>
<td>2:1</td>
<td>100</td>
<td>4 months</td>
<td>Digitalis stopped without effect, redigitalization and maintenance dose increased</td>
<td>Sinus rhythm</td>
<td>Sinus rhythm</td>
<td>Rheumatic heart disease, severe psychoneurosis, living</td>
</tr>
<tr>
<td>5. M.M.</td>
<td>F</td>
<td>59</td>
<td>Maintenance digitalis</td>
<td>240–250</td>
<td>Variable</td>
<td>80–125</td>
<td>7 weeks</td>
<td>Digitalis stopped without effect, redigitalization and quinidine added</td>
<td>Atrial fibrillation</td>
<td>Atrial fibrillation</td>
<td>Rheumatic heart disease, diabetes mellitus, dead</td>
</tr>
<tr>
<td>6. W.W.</td>
<td>M</td>
<td>77</td>
<td>Partial redigitalization, and oral diuretic</td>
<td>200</td>
<td>2:1</td>
<td>100</td>
<td>Less than 1 month</td>
<td>Digitalis stopped without effect, redigitalization and oral diuretic substituted for oral diuretic</td>
<td>?</td>
<td>Sinus rhythm</td>
<td>Coronary artery disease, living</td>
</tr>
<tr>
<td>7. R.D.</td>
<td>F</td>
<td>58</td>
<td>Digitalization</td>
<td>188–195</td>
<td>2:1</td>
<td>94–98</td>
<td>2 days</td>
<td>None; maintenance digitalis continued and a mercurial shot given</td>
<td>Sinus rhythm</td>
<td>Sinus rhythm</td>
<td>Coronary artery disease, cerebral vascular accident, dead</td>
</tr>
<tr>
<td>8. A.C.</td>
<td>F</td>
<td>44</td>
<td>Maintenance digitalis</td>
<td>260</td>
<td>2:1</td>
<td>130</td>
<td>1 week</td>
<td>Digitalis stopped without effect, redigitalization and quinidine added</td>
<td>Sinus rhythm</td>
<td>Flutter, sinus rhythm</td>
<td>Atrial septal defect, living</td>
</tr>
<tr>
<td>9. F.R.</td>
<td>M</td>
<td>60</td>
<td>Maintenance digitalis</td>
<td>200–250</td>
<td>2:1</td>
<td>100–115</td>
<td>1 year</td>
<td>Digitalis stopped without effect, maintenance digitalis continued and oral diuretic added</td>
<td>Sinus rhythm</td>
<td>Atrial tachycardia with block</td>
<td>Cor pulmonale, living</td>
</tr>
</tbody>
</table>
# Table 2

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age</th>
<th>Prior cardiac treatment</th>
<th>Atrial rate</th>
<th>A-V conduction</th>
<th>Ventricular rate</th>
<th>Duration*</th>
<th>Treatment of arrhythmia</th>
<th>Prior rhythm</th>
<th>Subsequent rhythm</th>
<th>Clinical diagnosis, living or dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. E.F. F</td>
<td>82</td>
<td></td>
<td>Deslanoside 0.8 mg. i.v., digitoxin 1.4 mg. p.o., meralluride 2 ml. i.m. 2 days before</td>
<td>166–200</td>
<td>Variable</td>
<td>90–120</td>
<td>1 day</td>
<td>Not treated</td>
<td>Sinus rhythm</td>
<td>Sinus rhythm</td>
<td>Acute myocardial infarction, congestive failure, died in 7 days</td>
</tr>
<tr>
<td>11. M.H. F</td>
<td>86</td>
<td></td>
<td>Deslanoside 0.8 mg. i.v., digitoxin 1.2 mg. p.o., meralluride 2 ml. i.m. 3 days before</td>
<td>214–250</td>
<td>2:1</td>
<td>107–120</td>
<td>2 days</td>
<td>Not treated</td>
<td>Sinus rhythm</td>
<td></td>
<td>Coronary artery disease, congestive failure, died in 6 days</td>
</tr>
<tr>
<td>12. C.E. F</td>
<td>51</td>
<td></td>
<td>Deslanoside 0.8 mg. i.v., digitoxin 1.0 mg. p.o., mercaptopmerin 2 ml. i.m. 2 days before</td>
<td>200–233</td>
<td>2:1</td>
<td>100–110</td>
<td>3 days</td>
<td>Digitalis stopped, potassium added</td>
<td>Sinus rhythm</td>
<td>Sinus rhythm</td>
<td>Laennec’s cirrhosis, ascites, low potassium, congestive failure, living</td>
</tr>
<tr>
<td>13. L.T. M</td>
<td>55</td>
<td></td>
<td>Digoxin 0.75 mg. p.o. daily, chlorothiazide 500 mg. q.i.d., and for 4 days, benzodifumethazide 5 mg. daily</td>
<td>200</td>
<td>2:1</td>
<td>100</td>
<td>3 days</td>
<td>Digitalis and diuretics stopped, potassium added</td>
<td>Sinus rhythm</td>
<td>2° block Sinus rhythm</td>
<td>Old myocardial infarction, congestive failure, died in 3 months</td>
</tr>
<tr>
<td>14. M.M. F</td>
<td>67</td>
<td></td>
<td>Digoxin 0.25 mg. p.o. b.i.d., hydrochlorothiazide 100 mg. for 2 days, meralluride 2 ml. i.m.</td>
<td>180</td>
<td>2:1</td>
<td>90</td>
<td>5 days</td>
<td>Digitalis and diuretics stopped, potassium added</td>
<td>Sinus rhythm</td>
<td>Sinus rhythm</td>
<td>Rheumatic heart disease, congestive failure, living</td>
</tr>
<tr>
<td>15. W.K. F</td>
<td>44</td>
<td></td>
<td>Gitalin 0.5 mg. daily and chlorothiazide, dose unknown</td>
<td>140–160</td>
<td>Variable</td>
<td>80</td>
<td>1 day</td>
<td>Digitalis and diuretics stopped, potassium added</td>
<td></td>
<td></td>
<td>Rheumatic heart disease, history of congestive failure, living</td>
</tr>
</tbody>
</table>

*Since electrocardiograms were taken at random, the individual times represent a maximum duration.
digitalis since 1956, the drug having been stopped for 1 week twice and for 3 weeks with no change in the rhythm. When she was off digitalis once, however, atrial tachycardia without block occurred at a rate of 160 with a P-R interval of 0.20 second, a higher degree of atrioventricular block reappearing with carotid sinus pressure. Potassium and quinidine did not affect her arrhythmia. At present the ventricular rate is controlled at 75 to 100 beats per minute with digoxin 0.2 mg. daily. At no time have there been symptoms of digitalis intoxication.

Case 2

P.D. (JFII no. 98 28 19), a 64-year-old retired auditor with rheumatic heart disease, was admitted in December 1960 with mild congestive heart failure. He had been treated for Parkinson’s disease but had never had cardiac drugs. His serum electrolytes were normal. The electrocardiogram, on admission and at discharge, revealed atrial tachycardia with block. The atrial rate was 200 to 214, with a variable 2:1 to 4:1 ventricular response (fig. 1B). There were slight S-T sagging in the lateral leads and a rare ventricular premature beat. The P waves were small and upright in the posterior leads and triangular in the right precordial leads. Digitoxin was given 4 days after admission, 1.4 mg. over 2 days, followed by 0.1 mg. daily. After digitalization, the congestive failure cleared and 4:1 atrioventricular conduction predominated, with a ventricular rate of 50 to 60 beats a minute. He was also placed on a 1-Gm. salt diet and did not require diuretics. On follow-

Figure 1

Representative electrocardiographic strips from cases 1 to 7, illustrating atrial tachycardia with block. A, case 1, lead II, 9/26/60; B, case 2, V1, 3/17/61; C, case 3, V1 and V2, 10/13/60; D, case 4, V1, 11/26/60; E, case 5, V2, 9/14/60; F, case 6, V1, 9/23/60; G, case 7, lead II, 1/14/61.
up visit, 3 months later, there were no symptoms, and atrial tachycardia with block persisted with a controlled ventricular rate.

Case 3

V.K. (HFH no. 100 53 18), a 69-year-old white woman, was admitted from the emergency room on October 12, 1960, with an incarcerated left femoral hernia. Surgical reduction and resection of 8.5 cm. of infarcted small bowel were carried out the same day under local anesthesia. There was a prior history of angina pectoris and hypertension. She had not seen a physician for a year and was not on digitalis. The admission serum electrolytes were: sodium 127 mEq./L., potassium 4.6 mEq./L., chloride 90 mEq./L. and carbon dioxide combining power 23 mEq./L.

Two hours following surgery, the patient was restless and dyspneic. An electrocardiogram showed atrial tachycardia with block as well as nonspecific S-T wave depression in the anterior lateral leads. The P waves were small and difficult to see in the standard leads; the atrial rate was 190 and the ventricular rate 130, with varying 2:1 and 1:1 conduction (fig. 1C). Because of mild congestive heart failure, digitalization was started on October 13 with 1.2 mg. of digitoxin over 2 days followed by 0.1 mg. daily. She was also given 2 ml. of mercurilide sodium. There was rapid clinical improvement, and on October 15, sinus rhythm with first-degree block and a ventricular rate of 70 were present. This persisted until discharge, 2 weeks later.

Case 4

S.G. (HFH no. 42 12 62), a 56-year-old housewife, was first known to have mitral stenosis in 1944. Atrial fibrillation began in 1949. She was given digitalis, and attempts at conversion with quinidine were unsuccessful. There were numerous hospitalizations for congestive heart failure, and the patient refused to consider nitral valve surgery.

In July 1960, the patient had a normal sinus rhythm for the first time in 10 years. Her medications were: digitalis leaf, 1.28 gr. daily, a 4-Gm. salt diet, and rare mercurial injections every 3 to 4 months. At this time, quinidine, 200 mg. t.i.d., was added in an effort to maintain sinus rhythm. She continued on the same program and on November 25, 1960, complained of palpitation, increased fatigue, and dizziness. Atrial tachycardia with block was present by electrocardiogram with an atrial rate of 200 per minute and 2:1 atrioventricular conduction (fig. 1D). The tracing was otherwise normal, except for a rare premature ventricular beat and slight S-T depression. Digitalis and quinidine were discontinued for 2 weeks and 60 to 100 mEq. of potassium were added with no change in the arrhythmia. Serum electrolytes were normal. On December 9, the patient was given 1.6 mg. of deslanoside intravenously followed by maintenance digitalis leaf, two 1.28-gr. tablets daily. The atrioventricular block increased to 3:1 and 4:1 with symptomatic improvement. The arrhythmia continued without change for 4 months, at which time the patient was found to have a normal sinus rhythm. The patient then voluntarily decreased her digitalis to one tablet a day, and 1 month later again had atrial tachycardia at 200 with 2:1 block. Digitalis was increased to four tablets for 3 days followed by a maintenance dose of two tablets per day. In 2 weeks the atrioventricular block had increased to a variable 3:1 to 4:1 conduction and at latest follow-up, 2 months later, she was again in normal sinus rhythm. In addition to digitalis and a 4-Gm. salt diet, the patient had been on benzydrolmethiazide 10 mg. with supplementary potassium 3 times a week since January 1961. She never had symptoms of digitalis intoxication.

Case 5

M.M. (HFH no. 91 27 77) was a 59-year-old housewife with mitral stenosis, diabetes mellitus, atrial fibrillation, and hypertension. There was no congestive heart failure until August 1960, when she entered the hospital in acute pulmonary edema. She had been on a 1-Gm. salt diet and digitoxin 0.15 mg. daily without diuretics. On admission, the electrocardiogram showed right ventricular hypertrophy and atrial tachycardia with block; atrial rate, 240 to 250; ventricular rate, 80 to 125; and there was a variable 2:1, 3:1 block (fig. 1E). Serum electrolytes were normal. The arrhythmia persisted despite stopping digitalis for 5 days and adding 90 mEq. of potassium daily. She was discharged on digitoxin, 0.1 mg. daily, with a controlled ventricular rate of 80, but re-entered in 3 weeks in pulmonary edema, atrial tachycardia with block, and a ventricular rate of 130. On this occasion, digitoxin was stopped for 3 weeks, 90 mEq. of potassium and 2 Gm. of pro- caine amide were added daily. Meralluride sodium was given twice. The ventricular rate increased to 120 to 150 per minute on October 1 and she again went into failure. On October 3 she was given deslanoside, 1.6 mg. intravenously, followed by digitoxin, 1.2 mg. by mouth in divided doses over the next 2 days. Atrial fibrillation was rec- orded October 4 with the ventricular rate controlled at 80 to 100 beats per minute.

She did well in the clinic with the pulse running 68 to 100 but without electrocardiographic confirmation of the rhythm. In February 1961, the patient was readmitted in congestive heart failure and with a possible insulin reaction. She had been free of symptoms and had continued on a 1-Gm.
salt diet and digitoxin, 0.15 mg. daily, without diuretics. Admission electrocardiogram showed an atrial tachycardia at 214 with a ventricular rate of 75. When quinidine, 200 mg. q.i.d., was added, she converted to a normal sinus rhythm in 3 days with first-degree block (P-R 0.22 second). Sinus rhythm was again documented by electrocardiogram in the clinic while on maintenance quinidine. In May 1961, she developed pulmonary edema and died.

Case 6

W.W. (HFH no. 100 28 45) was a 77-year-old retired railroad accountant with coronary artery disease, who was first seen on September 17, 1960. He gave a history of dyspnea, fatigue, and ankle edema for 6 weeks. His family physician had started digitalis but the patient discontinued the drug 3 weeks before being seen because he felt so well. On his initial outpatient visit, he was in congestive heart failure and was given digitalis leaf, 0.9 Gm., over 3 days, then 0.1 Gm. daily as well as hydrochlorothiazide, 50 mg. daily, for 5 days. An electrocardiogram on September 23 revealed an atrial tachycardia of 200 per minute with 2:1 block and nonspecific S-T depression in the anterolateral leads (fig. 1F). When the patient was seen 4 days later, the importance of the arrhythmia was not recognized by the attending physician; digitalis was augmented to 0.1 Gm. b.i.d. for 3 days and meralluride sodium 2 ml. twice a week was substituted for hydrochlorothiazide because it was thought that the patient had not taken his medications regularly. From September 27 he was supervised by one of his family or a visiting nurse. At no time were there symptoms of digitalis intoxication, and he became edema-free and felt clinically well. A repeat electrocardiogram on October 27 showed a normal sinus rhythm.

Case 7

R.D. (HFH no. 101 38 96), a 58-year-old woman, was admitted in mild congestive failure in January 1961 and died 8 days later. There was a 10-year history of angina pectoris with more frequent pain the month preceding admission. Digitoxin was given, 1.2 mg. by mouth, in three divided doses the first day. An electrocardiogram on admission showed a sinus tachycardia of 136 with ventricular premature beats and minor S-T depression. On the following day, atrial tachycardia with block was found: the atrial rate was 188 and the ventricular rate 94 with 2:1 block (fig. 1G). Two days later, normal sinus rhythm had returned by electrocardiogram. The only diuretic given was meralluride sodium, 2 ml., the day after the discovery of atrial tachycardia with block. Digitoxin, 0.1 mg. daily, was continued, increased to 0.2 mg. a day after restoration of sinus rhythm. On the fifth hospital day, the patient experienced a transient left hemiparesis, which cleared. She was found dead in bed 3 days later. At no time were there symptoms suggesting digitalis excess.

Case 8

A.C. (HFH no. 91 36 91), a 44-year-old housewife, was first seen in May 1958 with a complaint of fatigue and paroxysmal rapid heart beat of 3 years' duration. Cardiac catheterization proved an atrial septal defect. Incomplete right bundle-branch block and a wandering pacemaker were found by electrocardiogram. On September 21, 1960, a repair of the atrial defect was done with open-heart surgery. Digitalization was accomplished 2 days before operation with 2.5 mg. of digoxin orally. On the first postoperative day, the electrocardiogram showed a mid-nodal rhythm at a rate of 84 beats per minute. Digitoxin was con-
Electrocardiogram from case 9 (F.R.) on 11/25/60. The tracing shows characteristics of both atrial flutter and atrial tachycardia with block. The atrial rate is 214, there are broad inverted P waves in the posterior leads and the P-P interval varies slightly.

Case 9
F.R. (HFH no. 36 68 09), a 60-year-old Negro truck driver, has had severe bronchial asthma, bronchiectasis, and pulmonary fibrosis since 1937. In 1958, he first developed congestive heart failure secondary to cor pulmonale. Since that time he has been on digitoxin, 0.1 mg. daily with two extra
Figure 4

Atrial tachycardia with 2:1 block where every other P wave is hidden in the T complex.
Only in esophageal lead E₅₅ or high V₁ with carotid sinus pressure are these P waves identified. (Patient C.N., H.F.H. no. 15 57 34, 6/17/61).

Tablets a week. He has been hospitalized many times for congestive heart failure and pulmonary insufficiency. In April 1960, he was admitted because of increasing dyspnea, and the electrocardiogram showed an atrial tachycardia with a 2:1 ventricular response. Digoxin was stopped for 2 weeks, during which time the heart failure progressed but the arrhythmia remained unchanged. The patient was then given a total of 1.0 mg. of digoxin, chlorothiazide, 500 mg. b.i.d. for 4 days, and 2 ml. of mercuric chloride sodium with a good diuresis.

The arrhythmia has persisted for a year. Digoxin has been increased at times as high as 1.8 mg. a week, which has increased the degree of atrioventricular block. There has been no electrolyte imbalance or symptoms of digitalis excess. The present program consists of a diet with no added salt, digitalis leaf, 0.1 Gm. daily, chlorothiazide, 250 mg. a day, and potassium chloride, 1 Gm. b.i.d.

The atrial rate has varied from 200 to 230 per minute. A representative electrocardiogram is seen in figure 3. There are right ventricular hypertrophy and broad inverted P waves in the posterior leads. When the patient was in sinus rhythm before April 1960, P waves were broad and tall, consistent with right atrial hypertrophy. Some P-P interval variation is occasionally noted, the interval including the QRS complex being shorter.

Discussion

The electrocardiographic diagnosis of atrial tachycardia with block is difficult. When small P waves are hidden in the preceding complex, the arrhythmia may be mistaken for sinus rhythm; or when the atrial rate is rapid, the tracing may resemble atrial flutter. The electrocardiogram illustrated in figure 4 is from a recent patient not included.
ATRIAL TACHYCARDIA AND DIGITALIS

in this series who had atrial tachycardia with block unrelated to digitalis. It is an excellent example, showing the difficulty of recognizing small P waves hidden in the preceding T complex. Only when esophageal leads and high V, were taken, did the true nature of the rhythm become apparent.

A more common problem is the confusion with atrial flutter. Many authors have thought that there is little difference in the electrocardiographic criteria for the diagnosis of atrial tachycardia with block as opposed to flutter.9, 9, 11–14 Some of these reports, however, included atrial rates as high as 300 or 400 per minute, which at the present time would generally be considered atrial flutter. Lown and co-workers9, 5 have presented clear-cut electrocardiographic criteria for differentiating the two arrhythmias. In atrial tachycardia with block, there should be isoelectric intervals in all leads, usually upright small P waves, possible P-P interval variation, and the atrial rate should be less than 250 per minute. In flutter, on the other hand, one sees a continuous baseline undulation in one or more leads, there is frequently inversion of P waves in posterior leads, the P-P interval is constant, and the atrial rate is usually more rapid than 250 per minute. Certain electrocardiograms will be found that are intermediate between these two arrhythmias, and clinical judgment must dictate diagnosis and therapy. Case 9 (fig. 3) shows features of both arrhythmias: the P waves are broad and inverted in the posterior leads, at times there is variation in the P-P interval, and the atrial rate is 214 per minute. This patient was included in the series because it was felt that the electrocardiogram showed more of the characteristics of atrial tachycardia with block than atrial flutter. Case 8 had an unusually rapid atrial rate for atrial tachycardia with block at 260 a minute, but was clearly not flutter, since digitalis treatment converted the rhythm to flutter. Figure 2 shows two strips of lead II from this patient 8 days apart: A, with the typical P waves of atrial tachycardia; B, with those of atrial flutter.

There is little doubt that digitalis is a cause of paroxysmal atrial tachycardia with block. MacKenzie in 1911 may have been the first to attribute this arrhythmia to digitalis, but Heyl in 1932 first clearly demonstrated that digitalis was a cause.15, 16 In a 50-year-old patient treated for congestive heart failure, the arrhythmia was repeatedly brought on when digitalis was given and ceased when it was omitted. Lown, Levine, and co-workers have correctly emphasized the importance of digitalis intoxication in the etiology of this arrhythmia. The six cases listed in table 2 illustrate this. Heavy doses of digitalis or diuretics were given in cases 10 to 13. Patients 14 and 15 had a more reasonable dose, but the drug was probably responsible, since the arrhythmia rapidly stopped with omission of digitalis and the addition of potassium.

Not all cases of atrial tachycardia with block are due to excessive digitalis; indeed, its administration may be beneficial. A year's experience has emphasized the variability of the arrhythmia as to its etiology, duration, and treatment. Nine of the 15 cases did not have digitalis intoxication and either continued on this medication or had the dose increased after digitalis excess was excluded. A brief summary of these patients appears under "case reports" as well as in table 1.

Patient 1 had a persisting rather than paroxysmal atrial tachycardia for 5 years, and digitalis was helpful in controlling the ventricular rate. When the drug was omitted, atrioventricular block lessened to 1:1 conduction with a ventricular rate of 160. The literature describes other such cases that have persisted as long as 25 years.17–20 Patients 2 and 3 developed the arrhythmia even though they had never received digitalis. The addition of digitalis for congestive heart failure resulted in clinical improvement in both cases; atrial tachycardia with block continued in one and stopped in the other. Patients 4 and 5 each had two recorded episodes of atrial tachycardia with block, lasting as long as 4 months. These patients had been on maintenance digitalis without diuretics. The discontinuance
of digitalis and the administration of potassium were without effect. When patient 4 voluntarily decreased her maintenance digitalis dose on one occasion, she went from sinus rhythm to atrial tachycardia with 2:1 block. Increased digitalis slowed the ventricular rate and was later followed by sinus rhythm. Patient 5 also illustrated the importance of digitalis in increasing atrioventricular block. When digitalis was stopped for 3 weeks, a rapid ventricular rate developed, followed by pulmonary edema. Only when a full digitalizing dose was given, did she convert to controlled atrial fibrillation. Several other authors have also pointed out the value of giving digitalis to control the ventricular rate in atrial tachycardia with block by increasing the degree of atrioventricular block.\cite{8,18-20} Patients 6 and 7 both developed the arrhythmia transiently within a short time after digitalization. Since the arrhythmia appeared soon after a modest digitalizing dose, it cannot be said with certainty that digitalis was not a cause. However, a maintenance dose was continued as well as diuretics, the patients reverted to sinus rhythm, and they showed no clinical evidence of digitalis intoxication. In patient 8, the omission of digitalis and administration of potassium did not alter the atrial tachycardia with block. Intravenous digitalization led to flutter followed by sinus rhythm. Patient 9 has been described above as showing features of both atrial tachycardia with block and atrial flutter. The arrhythmia has lasted a full year, and has not been influenced by stopping digitalis.

When one is faced with the problem of atrial tachycardia with block, the possibility of digitalis intoxication must always be considered. Digitalis and diuretics should be stopped and potassium should be added if there is no contraindication. Fortunately the response to this treatment is usually immediate when digitalis intoxication is the cause. The use of 40 to 80 mEq. of potassium will abolish the arrhythmia in hours instead of days or weeks. Lown and Levine gave 20 to 120 mEq. of potassium in 25 episodes of digitalis-induced atrial tachycardia with block. Within 30 minutes to 6 hours the abnormal rhythm reverted to normal in 23 of the 25 instances.\cite{8} When atrial tachycardia with block continues despite stopping digitalis, the likelihood of excessive digitalis as a cause diminishes, and its possible usefulness in therapy must be considered. Digitalis may be indicated to control the underlying congestive failure and often will prevent a rapid ventricular rate by increasing the degree of atrioventricular block.

Summary

Fifteen cases of atrial tachycardia with block were seen at the Henry Ford Hospital in 1 year. In nine cases the arrhythmia was not a result of digitalis excess. One of these nine patients had the arrhythmia for 5 years, and two others had not received prior digitalis. In four cases, stopping digitalis and adding potassium did not affect the arrhythmia. Two patients experienced a brief episode of the arrhythmia while continuing digitalis. The addition of digitalis or a continued maintenance dose was necessary to control congestive heart failure or a rapid ventricular rate in all nine patients. The six remaining patients with atrial tachycardia with block had digitalis intoxication.

When one first encounters this arrhythmia, the possibility of digitalis intoxication should immediately be considered. Digitalis and diuretics should be stopped and potassium added. If the arrhythmia persists despite this therapy, digitalis intoxication becomes less likely and the administration of the drug may be indicated.

References

4. LOWN, B., MARCUS, F., AND LEVINE, H. D.: Digitalis and atrial tachycardia with block: a
ATRIAL TACHYCARDIA AND DIGITALIS


Thomas Sydenham 1624-1689

Thomas Sydenham was not regarded as a great man in his own time. Born in 1624 he had as contemporaries many medical men of greater renown in their day, men who lorded it over him, but whose very names posterity has not remembered. Of his medical contemporaries only William Harvey and John Locke are today held in high esteem. Sydenham was a modest man like all the truly great, and cared little for the plaudits or the scoffing of men. No one would be more amazed than he himself could he know how the scientific world today regards him or with what universal acclaim it celebrated the tercentenary of his birth.—David Riesman, M.D. Thomas Sydenham, Clinician. New York, Paul B. Hoeber, Inc., 1926, p. 11.
Atrial Tachycardia with Block Treated with Digitalis
WILLIAM L. MORGAN and GERALD M. BRENEMAN

Circulation. 1962;25:787-797
doi: 10.1161/01.CIR.25.5.787

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1962 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/25/5/787

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org/subscriptions/