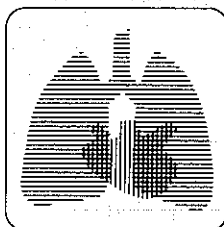


# **Exercise-Related Atrioventricular Block\***

## **Influence of Myocardial Ischemia**

*Neil L. Coplan, M.D.; Monty C. Morales, M.D.;  
Paul Romanello, M.D.; James R. Wilentz, M.D.; and  
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## Exercise-Related Atrioventricular Block\*

### Influence of Myocardial Ischemia

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A 62-year-old woman was noted to have complete heart block immediately following an exercise stress test. Coronary arteriography subsequently revealed a significant lesion in the right coronary artery, which was successfully dilated. Thallium-exercise testing following angioplasty showed no evidence of inducible ischemia and no arrhythmia was seen, supporting the idea that exercise-related heart block may occur secondary to myocardial ischemia.

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**E**xercise-related atrioventricular (AV) block is an uncommon arrhythmia that has recently been attributed to

\*From the Section of Cardiology, Department of Medicine, and the Nicholas Institute of Sports Medicine, Lenox Hill Hospital, New York.

Reprint requests: Dr. Coplan, NISMAT, 130 East 77th Street, New York 10021

intrinsic conduction system disease.<sup>1-3</sup> The following case report shows the importance of considering ischemia as a possible cause for exercise-related AV block.

### CASE REPORT

A 62-year-old woman underwent a treadmill exercise test to evaluate a two-week history of intermittent exertional substernal chest pain. Medications at the time of the test included diltiazem and aspirin. The resting electrocardiogram revealed normal sinus rhythm, normal intervals, and nonspecific ST-T wave changes. The exercise test was stopped 2.5 minutes into stage 1 of a Bruce protocol secondary to lightheadedness and nonsustained ventricular tachycardia; the electrocardiogram at this time showed sinus tachycardia and marked ST elevations in leads V<sub>1</sub>-V<sub>4</sub>. Within the first minute of recovery, the rhythm changed to 2:1 AV block (Fig 1), and soon afterward complete AV block was seen (Fig 2). At eight minutes into recovery, the acute ST changes had resolved and the rhythm returned to normal sinus.

The patient was admitted to the coronary care unit and a myocardial infarction was ruled out. Cardiac catheterization revealed a right dominant circulation, with a 90 percent proximal obstruction of the right coronary artery (Fig 3). The left anterior descending and circumflex arteries had no obstructions, and the ventricular conduction pattern was normal.

The patient subsequently underwent successful angioplasty using a perfusion balloon dilatation catheter to allow continuous blood flow during inflations; no arrhythmia occurred during the procedure. Follow-up thallium exercise testing three weeks later (while receiving diltiazem) revealed no arrhythmia or evidence of inducible myocardial ischemia.

### DISCUSSION

The course of this patient suggests that the exercise-induced AV block was related to transient myocardial ischemia. Transient ischemia was proposed as a cause for exercise-related AV block by Rozanski et al.<sup>4</sup> The idea that transient ischemia may result in AV block is supported by

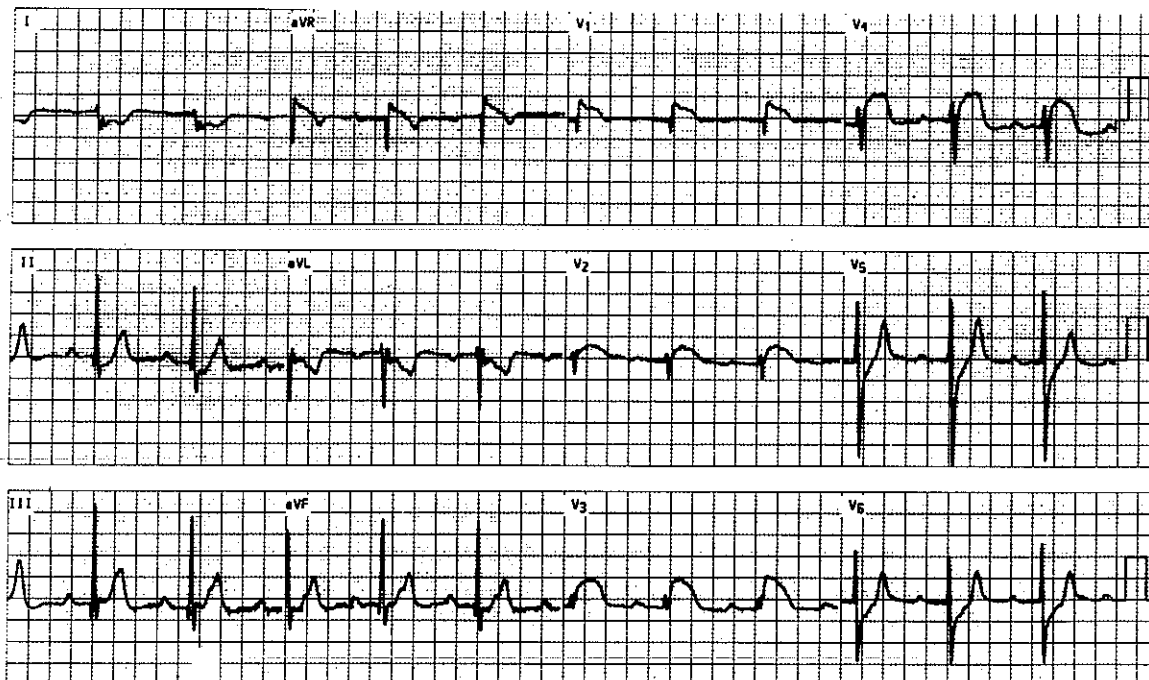


FIGURE 1. Electrocardiogram one minute following peak exercise, revealing acute ST elevation and 2:1 atrioventricular block with a narrow QRS complex.

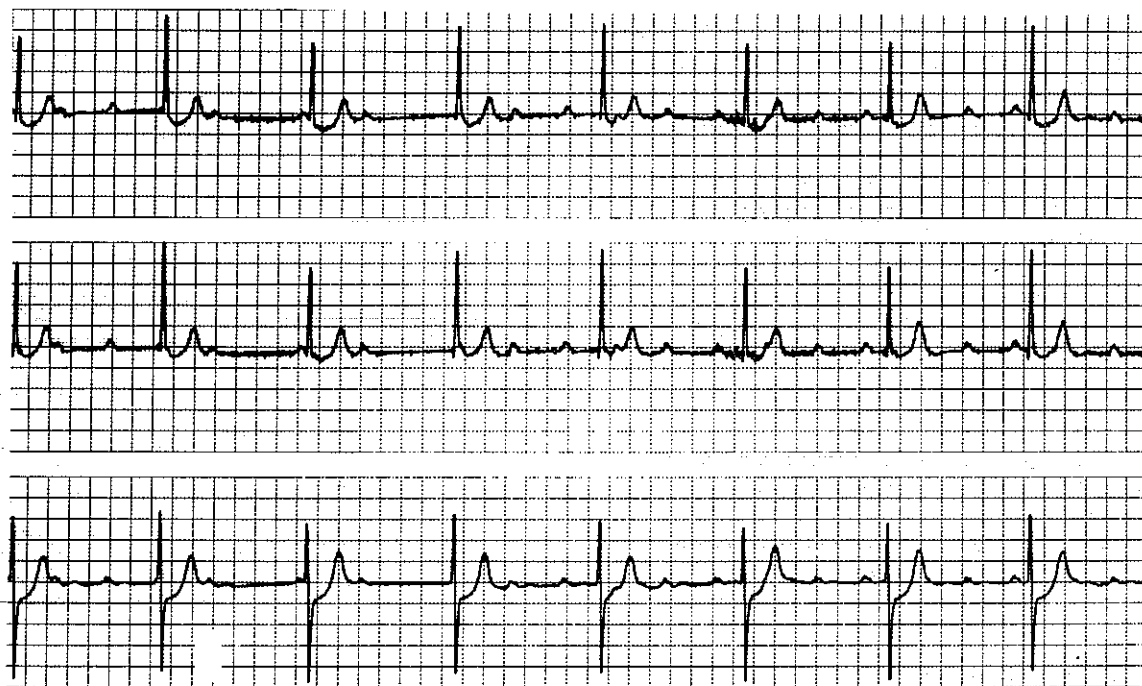


FIGURE 2. Electrocardiogram 1.5 minutes following exercise, revealing complete atrioventricular block and a narrow QRS complex. There are dropped P waves after the fourth and sixth P wave, suggesting concomitant sinoatrial exit block.

studies of patients with myocardial infarction that show that significant disease in the coronary artery giving rise to the AV node may result in AV block.<sup>5</sup> Further support is derived from a case report by Bharati et al<sup>6</sup> that demonstrated transient conduction block proximal to the His bundle occurring during an episode of presumed coronary artery spasm in a patient with 90 percent obstruction of the right coronary artery.

Exercise-induced ST elevations in the anterior precordial leads suggests severe disease in the left anterior artery,



FIGURE 3. Coronary angiogram revealing a significant proximal obstruction in a large dominant right coronary artery.

often occurring in association with marked left ventricular wall motion abnormality,<sup>7,9</sup> but cardiac catheterization did not reveal evidence of either problem in this patient. One explanation for ST elevations in the absence of significant obstructive disease is coronary artery spasm, which may also lead to nonsustained ventricular arrhythmia and heart block. However, while coronary artery spasm has been reported to occur during exercise,<sup>10-13</sup> none of these reports includes mention of exercise-related conduction block. In addition, the fact that the exercise-related ST elevation and arrhythmia occurred with the patient receiving a calcium channel blocker goes somewhat against attributing the findings to coronary artery spasm.

Although unusual, the marked ST elevations may have occurred secondary to induced ischemia in the territory of the right coronary artery.<sup>14,15</sup> Given the large area of distribution of the right coronary artery in the patient presented herein, which included blood supply to the AV node and a significant portion of the interventricular septum, conduction block could have resulted from transient AV nodal ischemia or secondary to ischemia of the infranodal system. The fact the exercise-related conduction block was not seen following angioplasty of the right coronary artery further supports this hypothesis.

Recent studies have found that exercise-related AV block occurs secondary to intrinsic conduction system disease.<sup>1-3</sup> It is important to note that standard electrophysiologic studies do not test for dynamic changes in the conduction system, such as may be induced by transient ischemia,<sup>6</sup> and therefore may not reproduce the physiologic changes occurring during exercise. In addition, the subjects in these series differ from the patient presented in the current case report; in contrast to our patient, four of nine patients in these reports had right bundle branch block on the baseline

electrocardiogram and no patient had significant ST-T wave changes on the exercise electrocardiogram. It is interesting to note that the two patients from these series who underwent coronary angiography were both shown to have disease of the right coronary artery.<sup>1,2</sup>

Myocardial ischemia should be considered a possible contributing factor to exercise-related heart block, particularly when coronary artery disease is suspected because of a history of chest pain or signs of ischemia during the exercise test. Failure to evaluate the presence and effect of myocardial ischemia may result in unnecessary pacemaker implementation in patients with exercise-related AV block.

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