

## Detection of 2:1 Atrioventricular Block by Echocardiographic Doppler Mitral Inflow Study

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### INTRODUCTION

Echocardiography is a commonly used diagnostic tool in diagnosing structural heart disease.<sup>1</sup> In this case report, usefulness of echocardiography in detecting and confirming 2:1 atrioventricular (AV) block is described.

### CASE REPORT

Echocardiography was performed on an 86-year-old patient for evaluation of his low extremity swelling in the absence of any other clinical symptoms or signs. The echocardiographic image of pulsed Doppler mitral inflow showing early (E) and late (A) diastolic filling waves is displayed in Figure 1 (top image). The E wave (early mitral inflow wave) reflects the pressure gradient from the left atrium (LA)-left ventricle (LV) generated by the active LV relaxation, while the A wave (late mitral inflow wave) reflects the pressure gradient generated by LA contraction during LV diastole. A single lead electrocardiographic (ECG) tracing showed bradycardia at 39 beats/minute. There was a pattern of alternating E-A and A waves on Doppler mitral inflow and probably 2:1 atrioventricular (AV) block on ECG tracing (Figure 1; bottom image). Further analysis of Doppler mitral inflow A, E waves, and P, QRS waves on the ECG revealed that there is constant relationship of P-A waves (solid, white arrows) to suggest a normal sinus rhythm, while alternating 2:1 P-A to QRS-E (broken arrows) waves confirm 2:1 AV block as his underlying rhythm. A subsequent 12-lead ECG showed normal sinus rhythm and complete AV block with ventricular escape rhythm of right-bundle branch block morphology (Figure 2). With his advanced age and ECG findings, a pacemaker was implanted successfully.

### DISCUSSION

The AV block is diagnosed by ECG and can be physiological or indicative of underlying cardiac conduction disease. The AV block is classified as 1st-degree, 2nd-degree, 3rd-degree, or complete block.<sup>2,3</sup> The 1st-degree AV block is defined as PR interval greater than 0.20 second on ECG. The 2nd-degree AV block is present when non-conducted P waves are observed at regular or irregular intervals; it is further sub-classified as Mobitz type I (Wenckebach) and type II block. The Mobitz type I AV block is characterized by progressive PR prolongation culminating in a non-conducted P wave, while in Mobitz type II, the PR interval remains constant prior to the blocked P wave. The block where only 2:1 AV conduction is present cannot be classified as either Mobitz I or II type. This 2:1 AV block can sometimes be misinterpreted as sinus bradycardia when the blocked P waves fall in or at the end of

T waves that might be mistaken as U waves. The 3rd-degree or complete AV block is defined when P waves and QRS complexes bear no relationship to one another; clinically, these patients usually have slow pulses and likely symptoms of dizziness or even syncope.

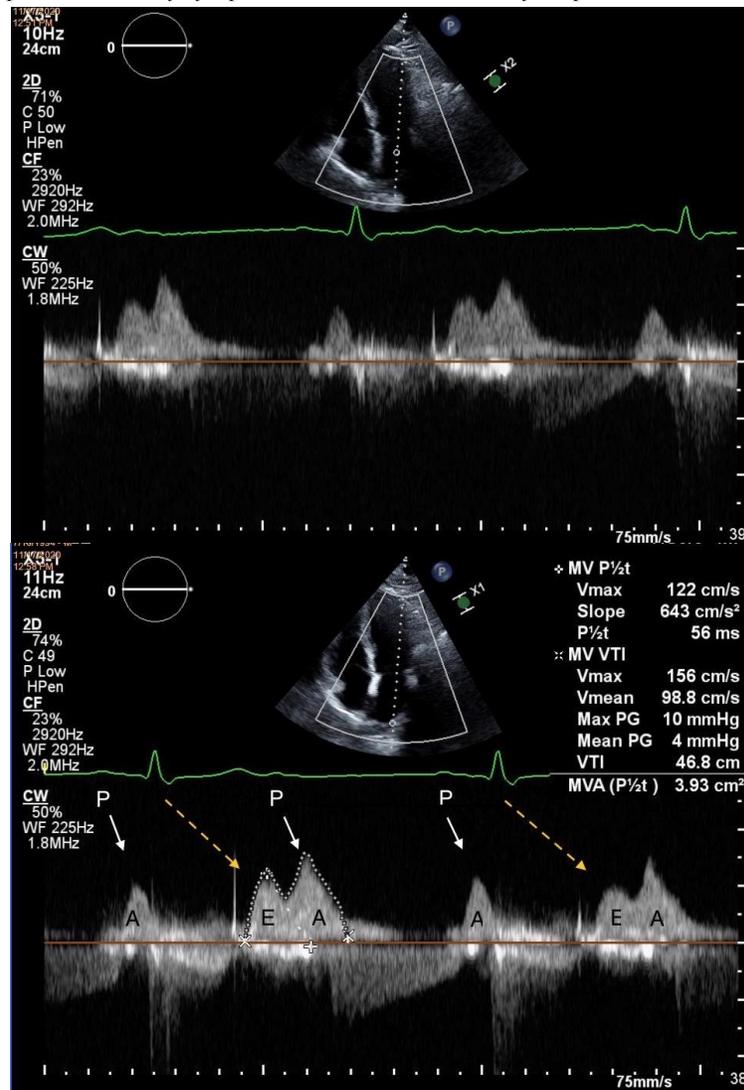


Figure 1. (Top) Echocardiographic image showed pulsed wave Doppler of mitral inflow of E and A waves and A waves with QRS and P waves on ECG are demonstrated here. There is constant relationship of P-A (solid, white arrows) and QRS-E (broken, yellow arrows) waves, but a 2:1 ratio of A-E waves on mitral inflow and P-QRS waves on ECG confirms the 2:1 AV block.

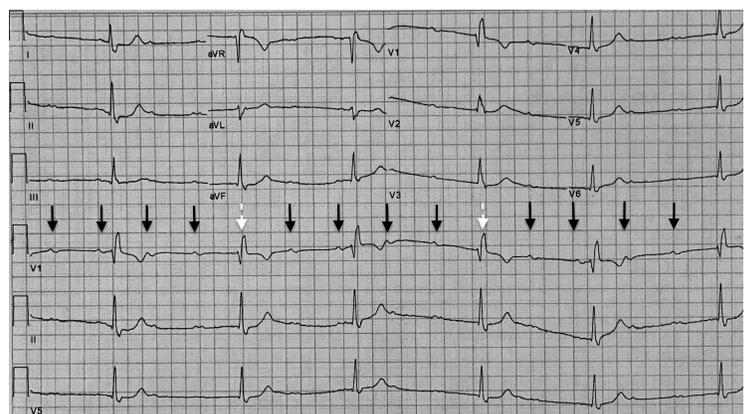


Figure 2. A 12-lead ECG obtained later in the same patient showed normal sinus rhythm and complete AV block with a slow ventricular escape rhythm of right bundle branch block morphology. In lead V1, solid black arrows pointed to P waves; broken white arrows indicated buried P waves within QRS complex.

Literature on echocardiographic findings of AV block included M-mode findings of A wave following P wave during AV block,<sup>4</sup> M-mode of mitral leaflets showing multiple A waves corresponding to atrial tachycardia rate during complete heart block,<sup>5</sup> and diastolic mitral or tricuspid regurgitation during AV block in animal and human models.<sup>6,7</sup> The effects on LV diastolic function reflected by E-A wave changes were only described during 1st-degree AV block, bundle branch block, and cardiac pacing.<sup>8</sup> This report showed a case of 2:1 AV block identified by observing the relationship of mitral inflow E-A waves on echocardiography to P-QRS waves on ECG. This simple observation confirmed 2:1 AV block even before an ECG was obtained.

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