

## IMAGES IN CARDIOLOGY

### 2:1 and Mobitz Type II Atrioventricular Block: A Common Fallible Diagnosis

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#### Abstract

A patient with Wenckebach phenomenon followed by runs of 2:1 atrioventricular (AV) block, labeled as Mobitz type II AV block by the referring physician, was referred for permanent pacemaker implantation. Apropos with this case and similar publications with this fallible diagnosis, the correct diagnosis of second degree AV block is revisited. It is pointed out that an ECG diagnosis of 2:1 AV block is by no means synonymous to Mobitz type II AV block, as two successive PR intervals are required to make a distinction between Mobitz type I and type II, which is never the case with a constant 2:1 AV block recording. On the other hand, the correct diagnosis can only be made by association. When longer ECG recordings are available and at least two consecutive PR intervals are seen, as in the present case, and one can discern a definite pattern of Mobitz type I (with progressive PR prolongation) or type II block (with stable PR intervals), then one can conclude that the 2:1 AV block is a consequence of one of the two types. *Rhythmos* 2018;13(2): 35-37.

**Key Words:** atrioventricular block; Wenckebach phenomenon; Mobitz type I block; Mobitz type II block; 2:1 AV block; permanent pacemaker

**Abbreviations:** AV = atrioventricular; ECG = electrocardiogram

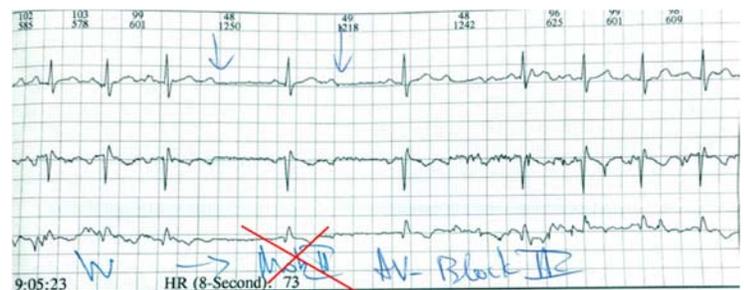
#### Introduction

It is a curious observation we have made over the years that some physicians, including general cardiologists, label a 2:1 atrioventricular (AV) block recorded on the surface electrocardiogram (ECG) as second degree Mobitz type II block, more commonly when it is constant wherein no two successive PR intervals are ever recorded, which would be the only way to render a diagnosis by determining the absence of progressive PR prolongation. This blatant diagnostic error has even been occasionally published without confutation.<sup>1, 2</sup> We herein present a case of transient 2:1 AV block which was diagnosed as Mobitz type II, even when it was preceded and followed by typical Wenckebach periodicity.

#### Case Report

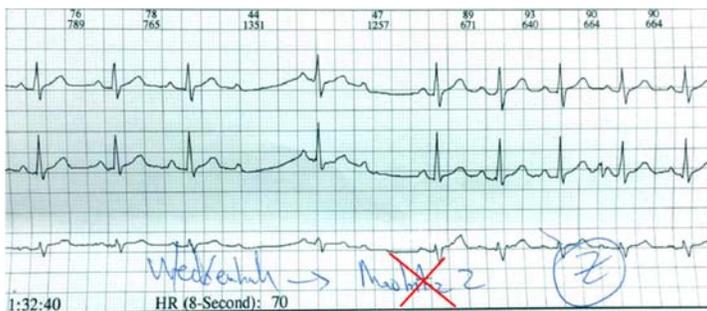
A 66-year-old lady was referred to the arrhythmia clinic for permanent pacemaker implantation after a

presumptive diagnosis of Mobitz type II AV block. The patient had symptoms of dizziness with no abnormal findings reported on initial history, physical examination and ECG recording. She was subsequently submitted to further work-up including a 24-hour Holter monitor recording, an echocardiogram and an exercise stress test. The latter two tests were reported normal, but print-outs of Holter recordings were indicated as diagnostic of second degree AV block, Mobitz type II. The patient brought these recordings with her with a hand-written diagnosis by the referring physician of Wenckebach followed by Mobitz type II during a run of 2:1 AV block (**Fig. 1 & 2**). However, on closer examination of the ECG strips, one can indeed discern that the three cycles of 2:1 AV block are preceded by progressive prolongation of the PR interval, while the first PR interval after the last blocked P wave is shortened again upon resumption of 1:1 AV conduction, and follows the same pattern of progressive PR prolongation, all consistent with second-degree AV block, Mobitz type I or Wenckebach phenomenon (**Fig. 1**). This is better illustrated in **Figure 2**, where the recording of an apparent Wenckebach leads briefly to 2:1 AV block with resumption of Wenckebach periodicity of the PR interval. Of course, the Wenckebach phenomenon was correctly characterized by the referring physician, who though mistakenly labeled the brief period of 2:1 AV block as “Mobitz type II”.



**Figure 1**

Upon taking a more detailed history, the patient described the dizzy spells typically consistent with positional vertigo and she was referred for an otolaryngology consultation. Upon physical examination, a right carotid bruit was also audible and the patient was referred for a carotid ultrasound and neurological consultation, as well. She was reassured about the ECG findings not requiring a pacemaker implantation at this juncture and her referring physician was also apprised accordingly.



**Figure 2**

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Second-degree AV block in the form of a 2:1 or higher degree (3:1, 4:1, etc.) AV block may be characterized as advanced second-degree (or high-degree) AV block, but is by no means synonymous to Mobitz type II AV block; some experts reserve the term of advanced or high-degree AV block only when multiple ( $\geq 3$ ) consecutive P waves are blocked in the absence of complete AV block.<sup>3</sup> At first, 2:1 AV block is neither Mobitz I nor Mobitz II block.<sup>4</sup> These are all ECG diagnoses. There have been correlations with the anatomic level of block, but this is a different story that is discussed below. Mobitz type I AV block or Wenckebach phenomenon is characterized by progressive PR prolongation before a P wave is blocked, while Mobitz II block has stable successive PR intervals before a blocked P wave. Thus, for characterizing a type I or II block, one has to see at least two successive PR intervals. In 2:1 AV block, never does one have two consecutive PR intervals available to compare, there is always only one PR interval every other beat, and thus cannot infer whether it is Mobitz type I or type II. However, this diagnosis can only be made by association. When longer recordings are available, as in the present case, and one can see a definite Mobitz type I or type II, then one can conclude that the 2:1 AV block is a consequence of one of the two types. In the present case, Mobitz I is apparent before and after the recordings of 2:1 AV block, thus this particular 2:1 AV block has emanated from Mobitz I AV block, and definitely not from Mobitz type II.

The level of block in 2:1 AV block can be either in the AV node or the His-Purkinje system.<sup>5</sup> In the majority of cases of Mobitz type I AV block, the level of block is in the AV node, while practically in all cases of Mobitz type II the level of block is infranodal (at the level of the His-Purkinje system). Hence, a diagnosis of Mobitz type II establishes a His-Purkinje system disease, wherein the probability of higher degree or complete AV block is high or impending and thus there is a need to implant a permanent pacemaker even in asymptomatic patients.<sup>6,7</sup> It is thus imperative to render a correct diagnosis to avoid

unnecessary pacemaker implantations. Nevertheless, even if a Mobitz type I diagnosis is established, when this leads to 2:1 or higher degree AV block associated with symptoms, and no correctable or reversible cause can be identified, then, even in such a scenario, a permanent pacemaker may also be required. Furthermore, if the 2:1 AV block is constant, albeit asymptomatic and with no detectable cause, one needs to determine the level of block with intracardiac recordings to make a decision about the need for a pacemaker implantation (see discussion below).

A type I block with a narrow QRS complex is almost always due to a lesion in the AV node because a type I block in the His bundle is rare. In a type I block with a wide QRS complex ( $\geq 120$  ms), except for acute myocardial infarction, the block is AV nodal in 30% to 40% of cases and is in the His-Purkinje system in 60% to 70% of cases. The diagnosis of type I infranodal (with incremental block in the HV interval) block requires invasive His bundle recordings.

Practically all Mobitz type II blocks are infranodal.<sup>5</sup> About 70% of cases of type II block are associated with bundle branch block, and 30% are associated with a narrow QRS complex and are therefore within the His bundle. Hence, a narrow QRS does not exclude a type II block. On the other hand, not all cases of a 2:1 AV block and bundle branch block indicate infranodal block requiring pacing, since even in such cases, 15-20% of the block is in the AV node signifying a better prognosis and not necessarily an indication for a pacemaker, at least for the asymptomatic patient. Both type I and type II blocks can progress to a 2:1 AV block, and a 2:1 AV block can regress to a type I or type II block. Consequently, the importance of the lesion in a 2:1 block can often be determined by the company it keeps. If the conduction ratio changes to or previous ECGs show a 3:2, 4:3, etc., AV block with at least 2 consecutively conducted P waves, the abnormalities may evolve into a type I or type II. In a persistent 2:1 AV block, His bundle recordings will be required to localize the site of the block.

Thus, a persistent 2:1 AV block cannot be classified, it is just “2:1 AV block” and cannot be automatically labeled as or ascribed to Mobitz I or II, unless typical recordings of these specific blocks are documented preceding or following periods of 2:1 AV block during longer ECG recordings; again, when only 2:1 AV block is the only rhythm recorded, the level of block can be determined with intracardiac recordings, particularly in asymptomatic patients with no correctable cause, when a decision is required for pacemaker implantation. In cases of associated symptoms, intracardiac recordings are not really required, since there is already a need for pacemaker

implantation if no reversible causes are elicited, regardless of the site of block.<sup>4,8</sup>

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