

12.1 Case Summary

A 59-year-old female, with no significant past medical history, presented to her primary care doctor with worsening dyspnea on exertion and an episode of loss of consciousness. She was in her usual state of health until 2–3 weeks prior to presentation when she started having dyspnea on exertion when ambulating upstairs or walking for about 1 mile. She had a viral illness 3 weeks prior which had now resolved. Her EKG showed sinus rhythm with 2:1 AV block (Fig. 12.1). Stress echocardiogram had been done 6 months prior which showed normal left ventricular (LV) systolic function, normal right ventricular function, no valvular abnormalities and stress was negative for inducible ischemia. She underwent evaluation with a cardiac MRI which was entirely normal. There was no evidence of cardiac sarcoidosis. Serum and urine protein electrophoresis, viral panel, Lyme antibody panel and TSH was normal. She underwent an Invasive EP study. Can the anatomical level of block be determined from the presenting EKG?

12.2 Case Discussion

When a patient presents with 2:1 AV block, it is often impossible to unequivocally determine the anatomical site of block [1]. In this case a narrow QRS during 2:1 conduction (Fig. 12.1) suggests AV nodal block. However an older ECG (Fig. 12.2) with 1:1 conduction and bifascicular block suggests disease in the His Purkinje System. Localization of the site can easily be done by evaluating the His bundle recording during invasive electrophysiological testing [2],

however careful analysis of the Surface EKG, and the observing the effect of exercise and pharmacological agents can be helpful in determining the anatomical site of block [1, 3].

A long strip of the rhythm is helpful. If there is a change in the conduction ratio to 3:1 or greater (Advanced AV block), this suggests Infra-Hisian block. If there is change in the in the QRS morphology with wide QRS or alternating bundle branch block, this suggests block in the His-Purkinje system in 80% of cases and AV node in 20% of cases. If the QRS is narrow and the PR interval is extremely long (>300 ms), this may suggest block in the AV node. Our patient had a previous EKG which revealed RBBB and LPFB, with this in consideration, the level of block is most likely in the His Purkinje System.

A number of maneuvers can also be employed to determine the mechanism [4]. Carotid sinus massage slows the sinus rate allowing the AV node more time to recover and may reduce the block from 2:1 to 3:2 and unmask any progressive prolonged PR intervals that would indicate an AV nodal site of block. Atropine can enhance AV nodal conduction and eliminate 2:1 AV block if the site of block is in the AV node. Exercise can also enhance the AV nodal conduction eliminating 2:1 block, however AV node block may paradoxically increase due to sinus rate increase and the block may not improve.

During invasive electrophysiology study we noted in normal sinus rhythm 2:1 conduction (Fig. 12.3). There was a His electrogram after each atrial electrogram suggesting that the level of the block was Infra-Hisian. Given her presentation we proceeded with implantation of a dual chamber His Bundle pacemaker which achieved non-selective His Bundle Capture (Fig. 12.4).

J. Payne · J. Weinstock (✉)
Cardiac Arrhythmia Center, Tufts Medical Center,
Boston, MA, USA
e-mail: Jpayne3@tuftsmedicalcenter.org;
jweinstock1@tuftsmedicalcenter.org

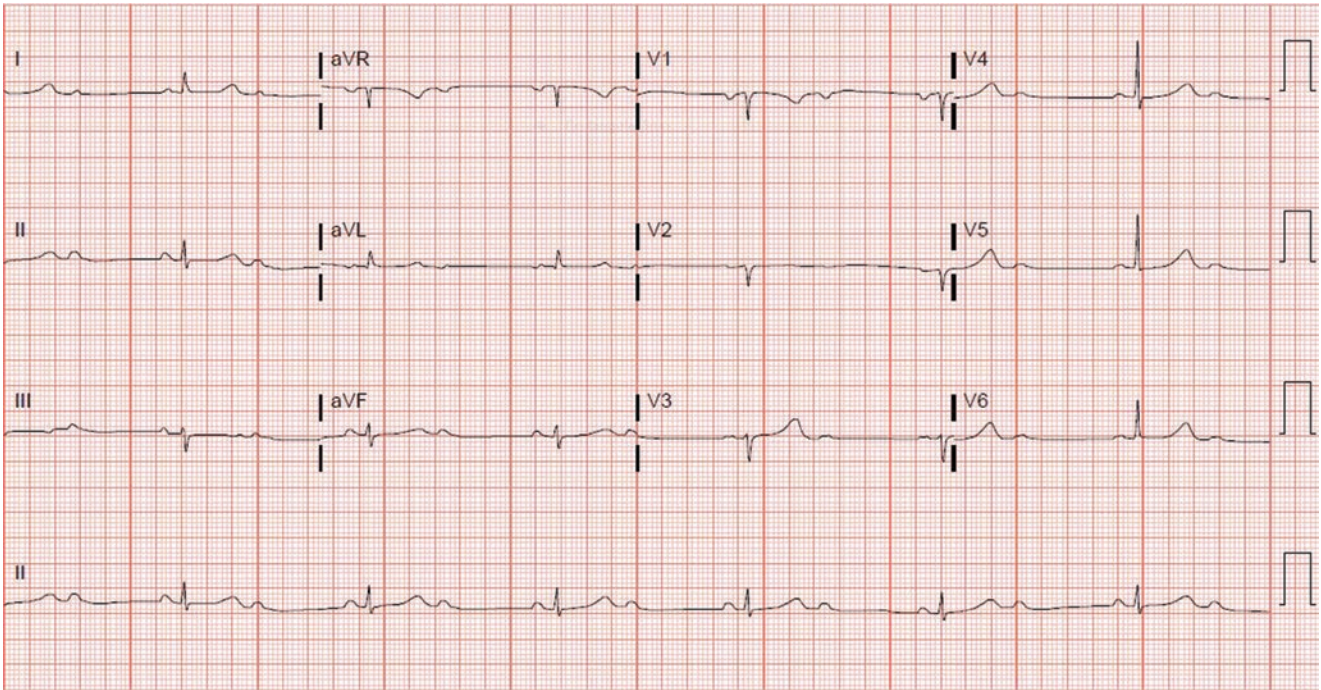


Fig. 12.1 There is normal sinus rhythm with 2:1 AV conduction. The PR interval and QRS duration is normal

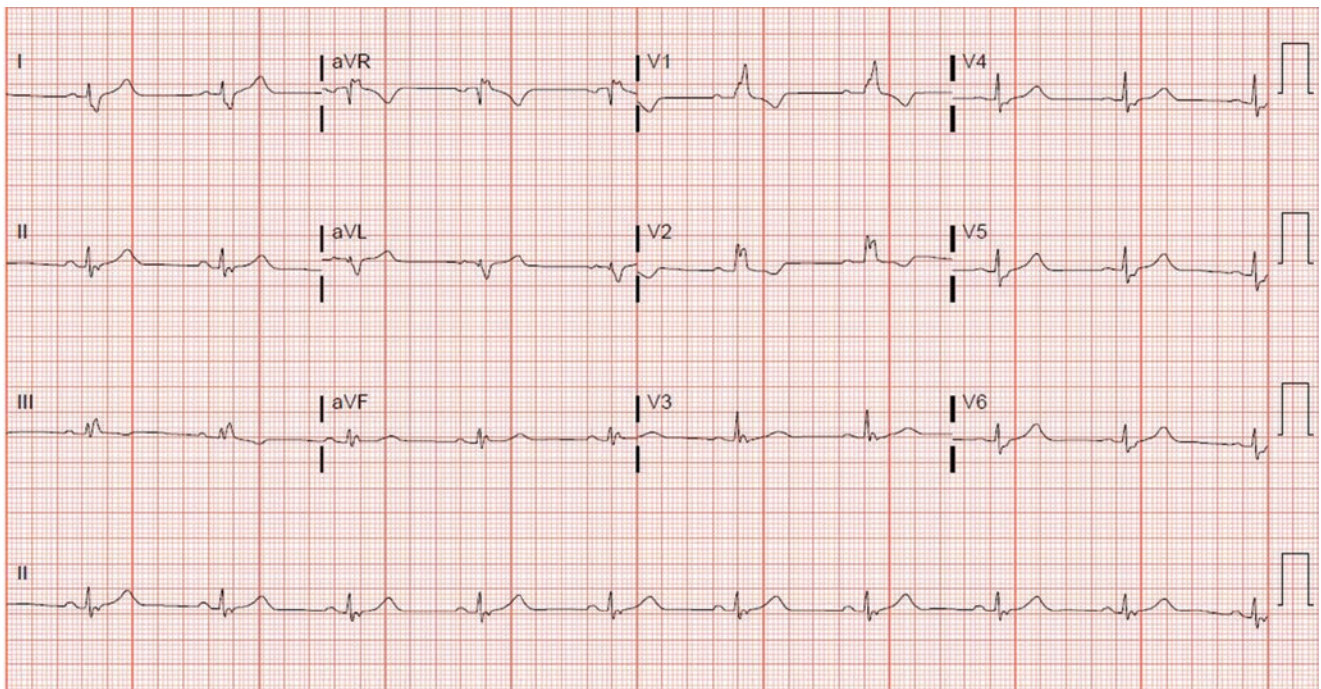


Fig. 12.2 Normal sinus rhythm with right bundle branch block and left posterior fascicular block



Fig. 12.3 12 lead surface EKG with intracardiac electrograms showing His bundle electrograms of 2:1 AV block located in the His Purkinje System. Every atrial depolarization is followed by a His deflection and

the A–H interval is constant, but every other atrial depolarization fails to conduct to the ventricle

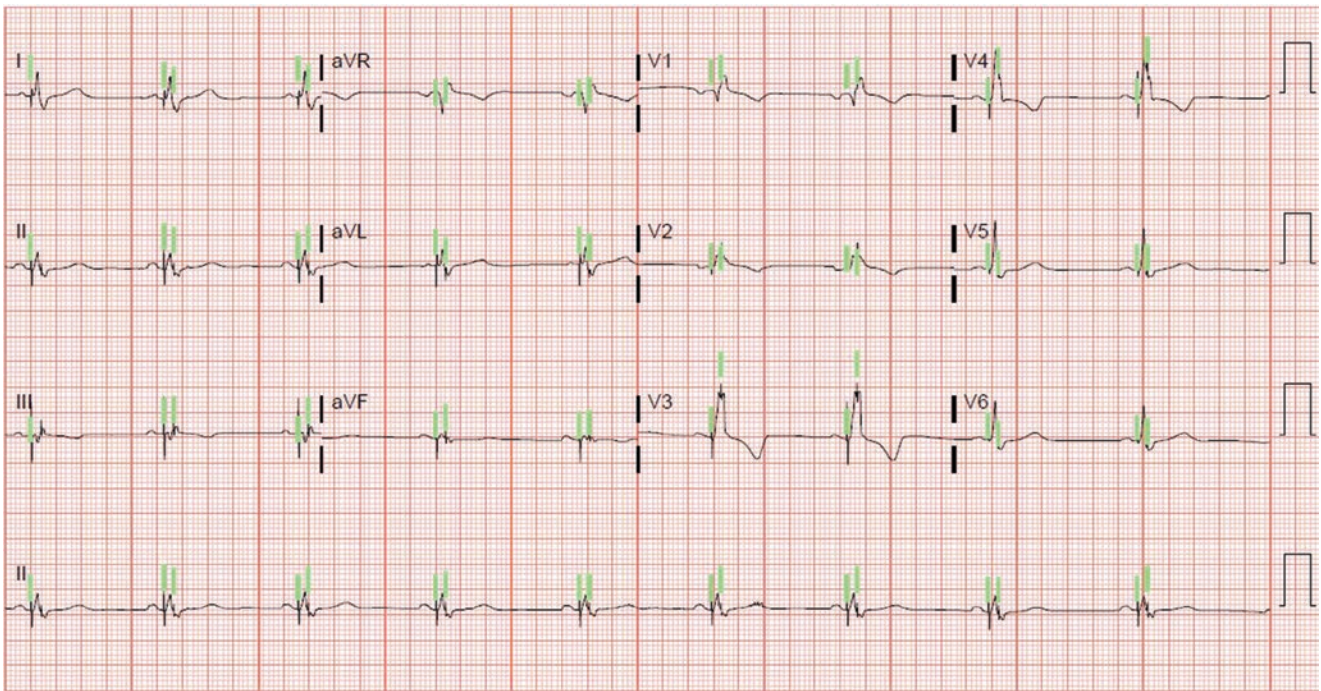


Fig. 12.4 12 lead surface EKG showing non-selective His bundle pacing

References

1. Barold SS. 2:1 AV block. *Herzschrittmachertherapie + Elektrophysiologie*. 2016;27(2):154–5.
2. Narula OS, Scherlag BJ, Samet P, Javier RP. Atrioventricular block. Localization and classification by His bundle recordings. *Am J Med*. 1971;50(2):146–65.
3. Langendorf R, Cohen H, Gozo EG. Observations on second degree atrioventricular block, including new criteria for the differential diagnosis between type I and type II block. *Am J Cardiol*. 1972;29(1):111–9.
4. Mangiardi LM, Bonamini R, Conte M, Gaita F, Orzan F, Presbitero P, et al. Bedside evaluation of atrioventricular block with narrow QRS complexes: usefulness of carotid sinus massage and atropine administration. *Am J Cardiol*. 1982;49(5):1136–45.