First Impressions

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About the Author

George Veenhuyzen is an adult cardiac electrophysiologist at the Libin Cardiovascular Institute of Alberta in Calgary. He is interested in the diagnosis and management of all arrhythmias, particularly using catheter ablation.

A resident on her CCU rotation is concerned that her patient, a previously healthy 55-year-old woman admitted several hours prior with an acute coronary syndrome, may need a prophylactic pacemaker because of the development of a new bundle branch block. The 12-lead EKG of concern is shown in Figure 1. What is going on?

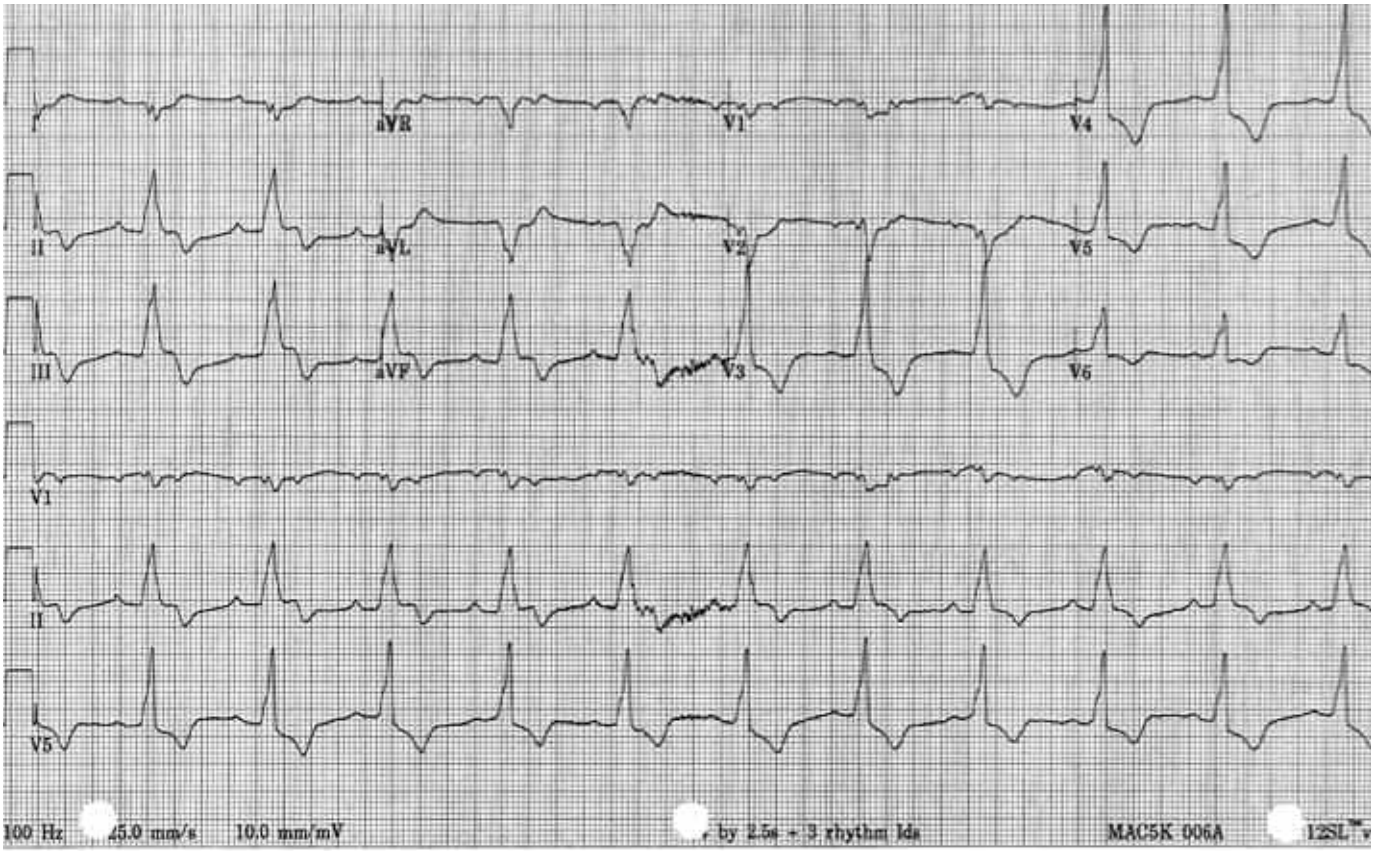

Figure 1

Discussion

This EKG reveals a regular wide complex (180 ms) rhythm at about 72 bpm. In lead II, there appear to be upright P waves before every QRS complex, and a normal P–R interval, suggesting normal sinus rhythm.

If the rhythm is indeed normal sinus, then the wide QRS complexes ought to be due to aberrant conduction, which usually means right or left bundle branch block (LBBB). The QRS complex morphology is most consistent with LBBB, though it is far from typical: (1) completely negative QRS complexes in leads I and aVL, (2) notching in the initial downward deflection of the QRS complexes in V1 and V2, and (3) a transition to a completely positive QRS complex by V3 are all quite unusual for LBBB. Perhaps this is not normal sinus rhythm with LBBB after all.

The 12-lead rhythm strip in Figure 2 clarifies the situation: there are in fact two sinus P waves for every QRS complex and the apparent "P–R interval" is longer at the end of the tracing than at the beginning. There is no relationship between these sinus P waves and the QRS complexes, only the coincidence that the sinus rate is very close to double the ventricular rate. The correct diagnosis is sinus tachycardia (approximately 145 bpm) with complete heart block and a ventricular escape rhythm (at approximately 72 bpm).

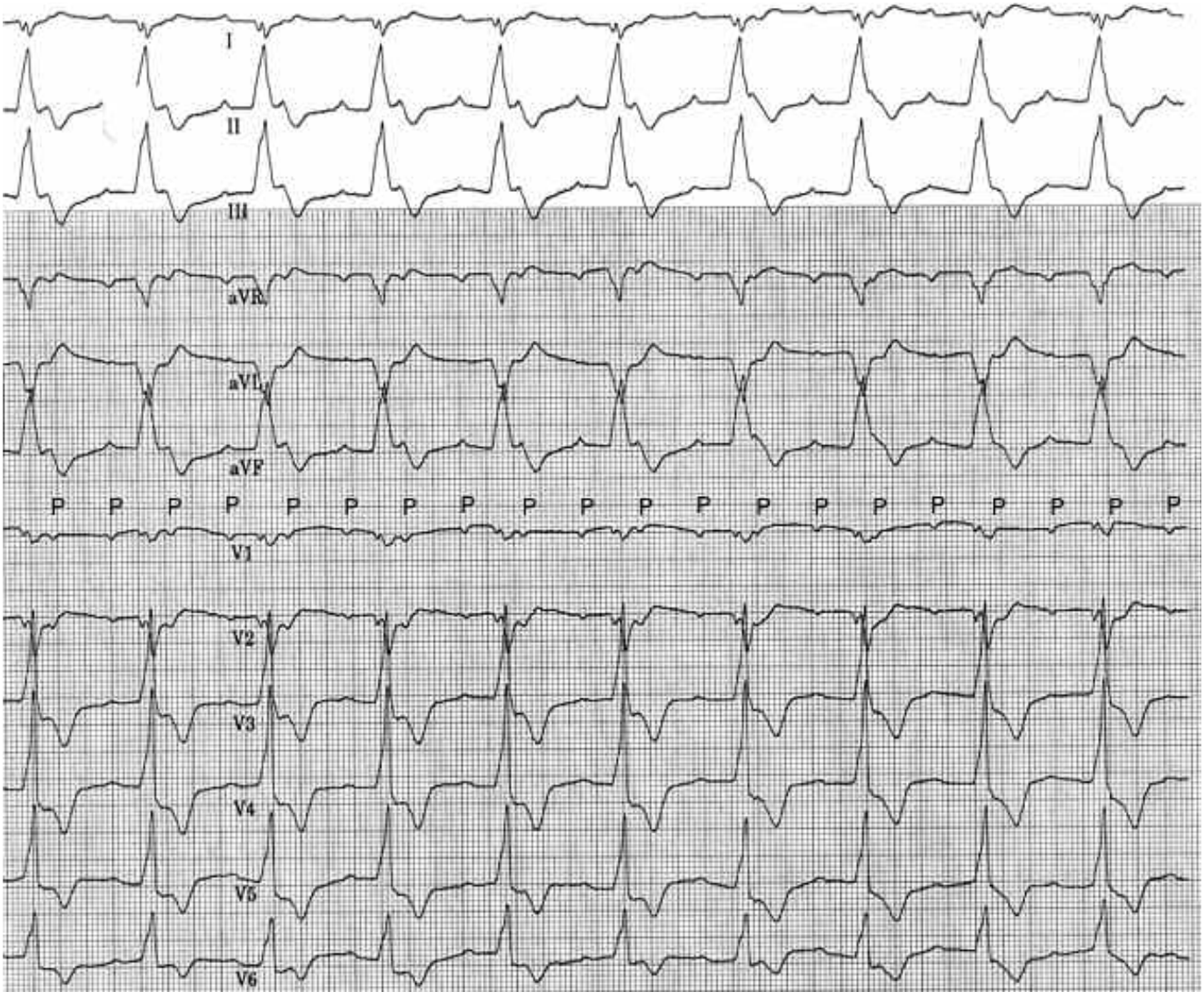

Figure 2

One other critical observation must be made: whenever the QRS complex is wide (bundle branch block, paced rhythm, etc.), particularly as wide as this one is, the ST segment and T wave should deviate to the opposite direction of the QRS complex. In leads V1 and V2, the QRS complex is negative, but the ST segment is depressed. Similarly, in leads II, III, and aVF, while the QRS is upright, the ST segment is elevated. This should raise concern about a potential current of injury, particularly in someone admitted to CCU with an acute coronary syndrome! Thus, despite the wide QRS ventricular rhythm, the acute inferoposterior injury current is fully interpretable and supported by the EKG when normal sinus rhythm has been restored in Figure 3.

Inferior myocardial infarctions (MIs) are often due to occlusion of the right coronary artery (RCA), especially when, as in this case, the amount of ST elevation in lead III exceeds the amount of ST elevation in lead II (the current of injury is pointing to the right). Complete LBBB is very unusual in the setting of single vessel RCA occlusions as the blood supply of the left bundle is dual, including the posterior descending artery (a branch of the RCA) and the septal perforators (branches of the left anterior descending artery). Thus, suspicion of the development of complete LBBB in the setting of an acute inferior MI should raise suspicion that there is multivessel coronary artery disease (CAD) and/or prior infarct(s), or that the wide QRS complex is not due to LBBB at all.

While a temporary pacemaker may be necessary for hemodynamic instability that can accompany complete heart block in the setting of an inferior MI, permanent pacing is almost never required. Prompt reperfusion often restores atrioventricular conduction, though in some cases, it may take over a week.

The challenging clues in this EKG lie in the recognition that the QRS morphology and ST segments are not typical for LBBB. These features raise suspicion regarding the nature of the rhythm (ventricular) and of

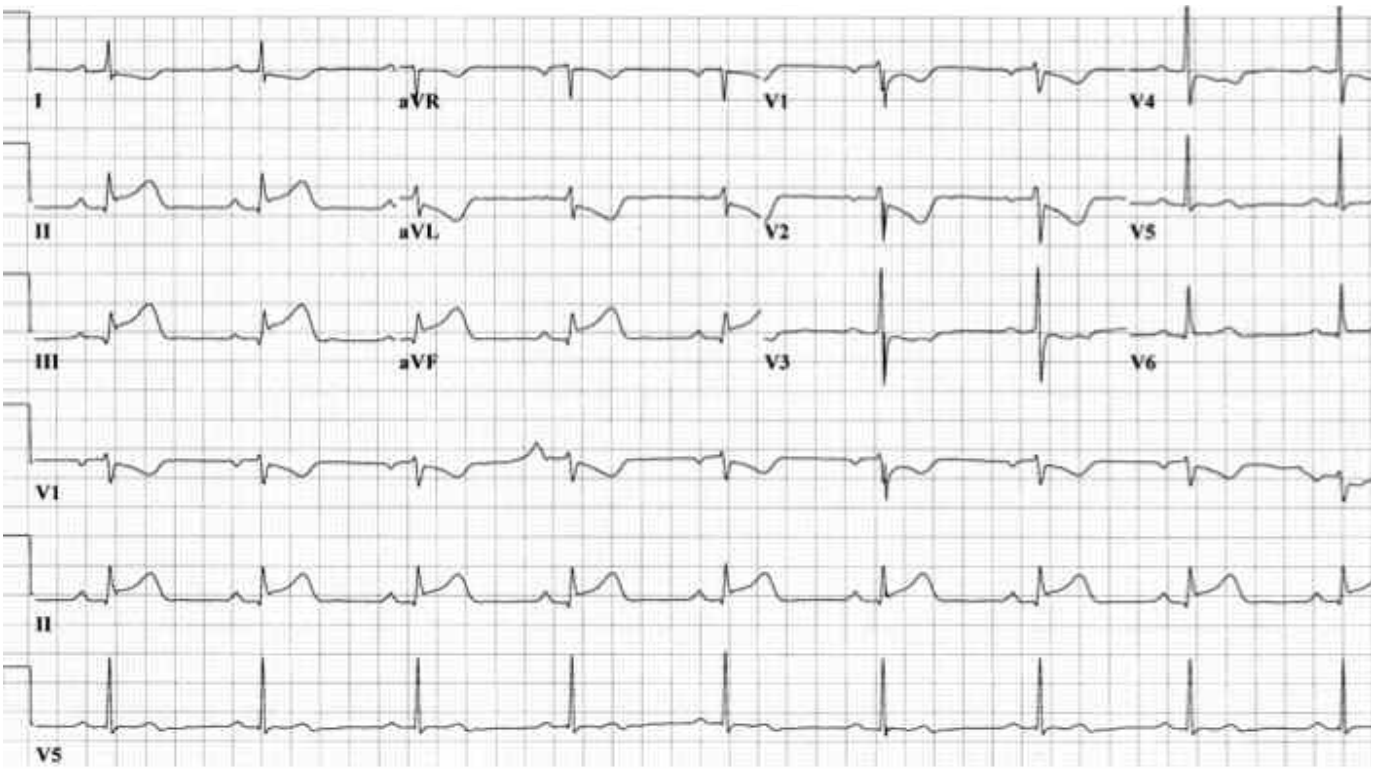

Figure 3

an acute current of injury (inferior ST elevation MI) that is responsible for complete heart block. While memorizing certain numbers and equations is essential for correct interpretation of acid-base disturbances, correct EKG interpretation requires memorization of the typical morphology of left and right bundle branch blocks. The next EKG & U column will serve to reinforce this concept.