CLINICAL VIGNETTE

Atrioventricular Nodal Block in Acute Inferior Myocardial Infarction

Stephen P. Vampola, MD

Case Summary

An 83-year-old man with a history of coronary artery disease, hypertension and type 2 diabetes mellitus presented to the emergency department following an episode of non-radiating substernal pressure-like chest pain that began at rest when he was in bed. He denied lightheadedness, dizziness, nausea, vomiting and palpitations. His chest pain lasted for approximately 1 hour and resolved spontaneously prior to hospital arrival. The patient had percutaneous coronary intervention 9 years prior with drug-eluting stents in his circumflex and left anterior descending coronary arteries. His home medications included only aspirin and amlodipine.

In the emergency department, the patient was asymptomatic. Blood pressure was 139/84 mmHg with heart rate of 48 bpm. His initial labs included an initial elevated high sensitivity troponin-T of 29 ng/L (reference range: < 12 ng/L). Electrolyte levels and blood counts were unremarkable and chest x-ray showed no acute disease. An electrocardiogram (ECG) showed sinus rhythm with third-degree atrioventricular (AV) nodal block and an escape rhythm in a left bundle branch block pattern at a rate of 49 beats per minute (Figure 1).

The patient was taken urgently to the cardiac catheterization lab, where a temporary transvenous pacemaker was placed and coronary angiography was performed. He had right-dominant coronary anatomy with 70-80% stenosis in the mid right coronary artery with angiographic findings suggestive of a plaque rupture (Figure 2). This lesion was treated with a single drug-eluting stent with an excellent angiographic result. Angiography also noted chronic total occlusion of his left anterior descending coronary artery, which was not treated.

Following the procedure, the patient was monitored in the intensive care unit with the temporary transvenous pacemaker. By hospital day 4, the patient's ECG showed sinus rhythm with first degree AV block. He patient was discharged home with a plan for early follow up with his cardiologist.

Discussion

Third-degree AV block, also called complete heart block (CHB), represents a complete dissociation between the electrical activity in the atria and the ventricles. ECG will characteristically show independent atrial and ventricular rates (Figure 1). Patients in CHB often have an escape rhythm, where pacemaker activity below the injured portion of the conduction system generates a perfusing rhythm. If the conduction system is injured above the His bundle, a narrow-complex escape rhythm with a heart rate above 40 beats per minutes is typically present. If the injury is below the His bundle, a slower wide-complex rhythm is more common. Unstable patients in CHB should be treated emergently with atropine, aminophylline and/or transcutaneous pacing followed by transvenous pacemaker placement.[1] Stable patients are monitored with backup pacing pads available. Evaluation for reversible causes, including AV nodal blocking medications, severe electrolyte disturbances, severe thyroid dysfunction and ischemic heart disease should be pursued.

CHB is a well-documented complication of myocardial infarction (MI). Although the incidence has decreased with the wide use of coronary stents, 3.2% of STEMI patients still develop CHB.[2] Although CHB is associated with increased mortality in the setting of MI, it is not a current independent predictor of mortality.[3] CHB is more common in inferior MI due to the vascular supply for the AV node, which arises inferiorly.[4] However, due to the level of injury, inferior infarcts tend to result in narrow complex rhythms without profound bradycardia. In patients like ours, with concomitant left-sided coronary disease, a slower wide-complex rhythm is not uncommon. In this setting, CHB creates a unique diagnostic challenge as typical ECG diagnostic criteria for MI may be unreliable. Because of this, patients with CHB and wide QRS complexes should be taken for coronary angiography urgently if their presentation is otherwise suggestive of acute MI.

CHB from MI, especially inferior MI, often resolves after revascularization. However, it commonly takes up to seven days, and sometimes longer, for reliable conduction to return.

Conclusion

Complete heart block is a well-known complication of MI, especially inferior MI. With CHB, wide-complex rhythms may prevent the ECG from being a reliable tool to evaluate for ischemia and coronary angiography should be pursued if the presentation is otherwise suggestive of MI. CHB from MI is often reversible, but may take seven days or longer for recovery to occur. Patients who have persistent CHB require permanent pacing.

Figures

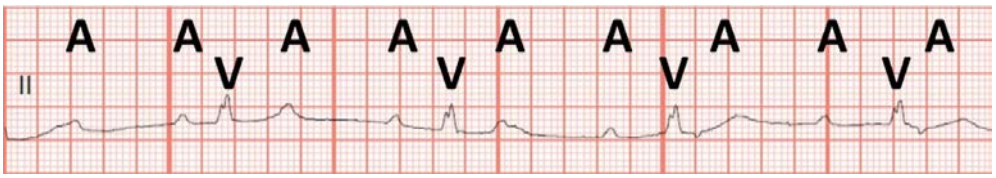

Figure 1: Lead II of the patient's ECG showing complete (third degree) heart block. The atria and ventricles are dissociated as demonstrated by the atrial P waves (denoted "A") and the ventricular QRS complexes (denoted "V").

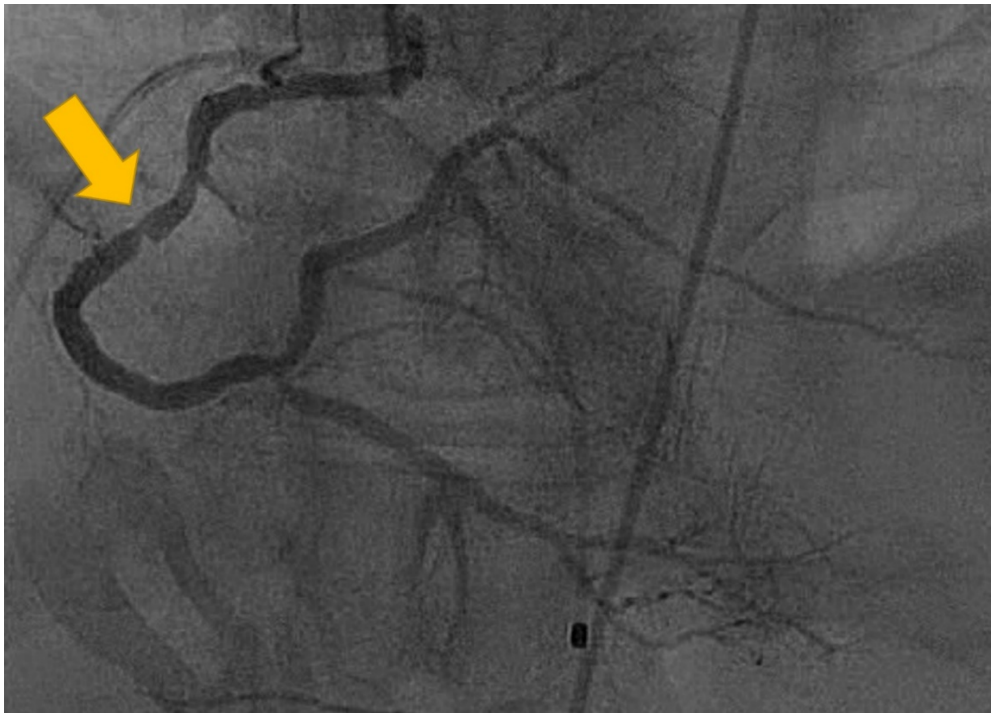

Figure 2: Selective coronary angiography of the right coronary artery shows focal stenosis, consistent with a recent plaque rupture event.

REFERENCES

1. **Kusumoto FM, Schoenfeld MH, Barrett C, Edgerton JR, Ellenbogen KA, Gold MR, Goldschlager NF, Hamilton RM, Joglar JA, Kim RJ, Lee R, Marine JE, McLeod CJ, Oken KR, Patton KK, Pellegrini CN, Selzman KA, Thompson A, Varosy PD**. 2018 ACC/AHA/HRS Guideline on the Evaluation and Management of Patients With Bradycardia and Cardiac Conduction Delay: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *J Am Coll Cardiol*. 2019 Aug 20;74(7):e51-e156. doi: 10.1016/j.jacc.2018.10.044. Epub 2018 Nov 6. Erratum in: *J Am Coll Cardiol*. 2019 Aug 20;74(7):1016-1018. PMID: 30412709.
2. **Gang UJ, Hvelplund A, Pedersen S, Iversen A, Jøns C, Abildstrøm SZ, Haarbo J, Jensen JS, Thomsen PE**. High-degree atrioventricular block complicating ST-segment elevation myocardial infarction in the era of primary percutaneous coronary intervention. *Europace*. 2012 Nov;14(11):1639-45. doi: 10.1093/europace/eus161. Epub 2012 May 29. PMID: 22645234.
3. **Auffret V, Loirat A, Leurent G, Martins RP, Filippi E, Coudert I, Hacot JP, Gilard M, Castellant P, Rialan A, Delaunay R, Rouault G, Druelles P, Boulanger B, Treuil J, Avez B, Bedossa M, Boulmier D, Le Guellec M, Daubert JC, Le Breton H**. High-degree atrioventricular block complicating ST segment elevation myocardial infarction in the contemporary era. *Heart*. 2016 Jan;102(1):40-9. doi: 10.1136/heartjnl-2015-308260. PMID: 26660871.
4. **Rathore SS, Gersh BJ, Berger PB, Weinfurt KP, Oetgen WJ, Schulman KA, Solomon AJ**. Acute myocardial infarction complicated by heart block in the elderly: prevalence and outcomes. *Am Heart J*. 2001 Jan;141(1):47-54. doi: 10.1067/mhj.2001.111259. PMID: 11136486.