CLINICAL VIGNETTE

Diagnosis of Acute Myocardial Infarction in a Patient with Known Left Bundle Branch Block

Alina Katsman MD, Ramin Tabibiazar MD, Ravi Dave MD

#

Case Report

A 78-year-old male with known left bundle branch block (LBBB) presented to the ED with four-hours of chest pain. He was given sublingual nitroglycerin but continued to have chest pain radiating to his left arm and his back. His past medical history was notable for glucose intolerance, and he was not taking any medications. He is a non-smoker and has no family history of premature coronary artery disease. His physical exam was remarkable for a blood pressure of 120/70, heart rate 70, JVP 6, and cardiac exam revealed regular rate and rhythm with a normal S1 and S2. An EKG was performed and showed normal sinus rhythm, left bundle branch block with anterolateral ST elevation (Figure 1). His prior EKG showed left bundle branch block (Figure 2). A serum troponin was elevated at 5. The patient was taken for urgent cardiac catheterization, which showed a 99% occlusion of the left anterior descending artery, and underwent successful percutaneous coronary intervention with a drug-eluting stent. The patient recovered well after the procedure and was discharged home.

Discussion

In patients presenting with chest pain, first study that is performed is often an electrocardiogram, as it can be a powerful and quick tool for the diagnosis of acute myocardial infarction (AMI). In patients with LBBB, however, the typical electrocardiographic manifestations of AMI or myocardial ischemia may be masked. As a result, the diagnosis of AMI in a patient with an existing LBBB can be quite challenging which may cause a delay in cardiac care. The diagnosis of AMI in a patient with an existing LBBB is called an "undetermined type myocardial infarction", and it is seen in approximately 6.5% of patients presenting with AMI, but it is associated with a mortality of 11.8%[1]. It is thus crucial to correctly diagnose an AMI in the setting of LBBB.

LBBB is often a chronic manifestation of hypertension and myocardial dysfunction rather than an acute abnormality[2]. LBBB is usually found in patients with structural heart disease associated with hypertrophy, dilation, as well as fibrosis of the left ventricular myocardium, ischemic heart disease, or various cardiomyopathies[3]. LBBB is also seen in patients with valvular heart disease and in patients with metabolic and electrolyte derangements. Degenerative disease of the conduction system (Lenegre disease) or sclerosis and calcification of the cardiac skeleton (Lev disease) also may lead to LBBB. The World Health Organization and the International Society and Federation for Cardiology Task Force established electrocardiographic criteria for LBBB [3-5]:

1. QRS duration is > 120 ms
2. Leads V5, V6, and aVL show broad and notched or slurred R waves
3. With the exception of lead aVL, no Q wave in left-sided leads
4. R peak time is prolonged by more than 60 msec in leads V5 and V6 and it is normal in leads V1 and V2 when it can be determined

Patients with LBBB have a change in the ventricular repolarization, which is discordant with the QRS complex; this leads to ST-segment elevation in leads with the presence of a negative QRS complex and ST-segment depression in leads with the presence of positive QRS complex. Thus, these changes may mimic myocardial injury.

Several electrocardiographic signs have been proposed to assist in the diagnosis of infarction in patients with LBBB, but most of these had limitations and most physicians believed that acute myocardial injury could not be detected accurately in patients with LBBB. However, in 1996, the Sgarbossa's criteria for the diagnosis of acute myocardial infarction in a patient with LBBB were introduced[4]. There are three independent EKG criteria with their respective sensitivities and specificities listed below:

	Sensitivity	Specificity

#

Concordant ST-segment elevation of ≥ 1 mm in the presence of a positive QRS complex	73%	92%
Discordant ST-segment elevation of ≥ 5 mm in the presence of a negative QRS complex	31%	92%
ST-segment depression of ≥ 1 mm in lead V1, V2 or V3	25%	96%

The Sgarbossa criteria were established on the basis of the analysis of a group of patients from the GUSTO trial, in which 131 patients with chest pain and LBBB had their EKGs analyzed for ST segment changes to develop a set of electrocardiographic criteria for the diagnosis of AMI. Concordant T wave abnormalities can be seen during AMI in patients with known LBBB; however, these electrocardiographic findings are poorly sensitive. The authors created a system to predict AMI in the presence of LBBB with the use of 3 independent criteria: [1] ST-segment elevation ≥ 1 mm that is concordant with the QRS complex[2], ST-segment elevation ≥ 5 mm that is discordant with the QRS complex, and [3] ST-segment depression ≥ 1 mm in leads V1, V2, or V3. The authors used all possible combinations of these three independent EKG criteria to create a total score indicating the discriminatory power of each combination. It should be noted that these criteria are not useful in determining the anatomical location of the infarction[5]. Larger prospective studies are required to test the Sgarbossa criteria, but they are useful in that they are highly specific EKG signs for AMI in the presence of LBBB, which should help in facilitating the timely need for intervention.

#

Figure 1: EKG upon presentation with chest pain.

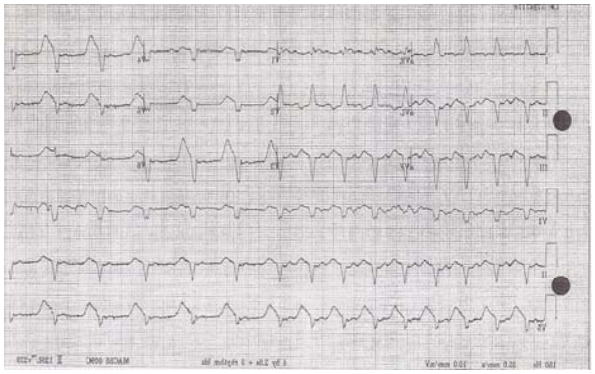
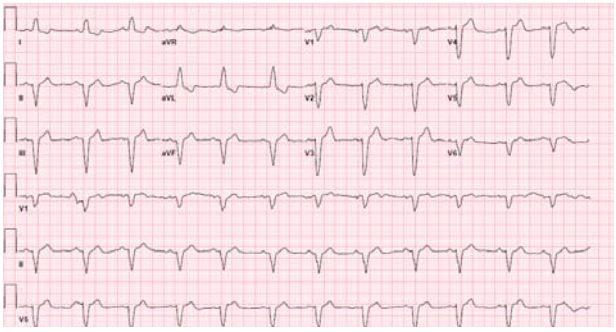


Figure 2: Baseline EKG with known left bundle branch block.



REFERENCES

1. **Hasdai D, Behar S, Wallentin L, Danchin N, Gitt AK, Boersma E, Fioretti PM, Simoons ML, Battler A**. A prospective survey of the characteristics, treatments and outcomes of patients with acute coronary syndromes in Europe and the Mediterranean basin; the Euro Heart Survey of Acute Coronary Syndromes (Euro Heart Survey ACS). *Eur Heart J*. 2002 Aug;23(15):1190-201. PubMed PMID: 12127921.
2. **Jaffe AS, Boyle AJ**. Acute Myocardial Infarction. In: Crawford MH, ed. Current Diagnosis & Treatment: Cardiology, 3rd ed. New York: McGraw-Hill; 2009.
3. **Surawicz B, Knilans T**. Left Bundle Branch Block in Chou's Electrocardiography in Clinical Practice, 5th ed, 2001.
4. **Sgarbossa EB, Pinski SL, Barbagelata A, Underwood DA, Gates KB, Topol EJ, Califf RM, Wagner GS**. Electrocardiographic diagnosis of evolving acute myocardial infarction in the presence of left bundle-branch block. GUSTO-1 (Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) Investigators. *N Engl J Med*. 1996 Feb 22;334(8):481-7. Erratum in: *N Engl J Med* 1996 Apr 4;334(14):931. PubMed PMID: 8559200.
5. **Kochiadakis GE, Kaleboubas MD, Igoumenidis NE, Skalidis EI, Vardas PE**. Electrocardiographic diagnosis of acute myocardial infarction in the presence of Ventricular paced rhythm. *Pacing Clin Electrophysiol*. 2001 Aug;24(8 Pt 1):1289-90. PubMed PMID: 11523618.

Submitted on October 16, 2012