Utility of Left Bundle Branch Block as a Diagnostic Criterion for Acute Myocardial Infarction

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The clinical utility of new or "presumably new" left bundle branch block (LBBB) as an electrocardiographic criterion equivalent to ST-segment elevation myocardial infarction in contemporary practice is not well established. The aim of this study was to investigate the hypothesis that new or presumably new LBBB in symptomatic patients frequently leads to an overdiagnosis of acute myocardial infarction (AMI). A retrospective analysis of data from consecutive patients in the Mayo Clinic's ST-segment elevation myocardial infarction network from July 2004 to August 2009 was conducted among 892 patients, 36 (4%) of whom had new LBBB. The frequency, clinical characteristics, serum troponin levels, coronary angiographic findings, and outcomes of patients with new LBBB suspected of having AMI were evaluated. Compared with patients without LBBB (n = 856), those with new LBBB were older (64.5 vs 72.9 years, p <0.001), had higher Thrombolysis In Myocardial Infarction (TIMI) risk scores (22.7 vs 31.0, p <0.005), were less likely to undergo primary percutaneous coronary intervention (86% vs 22%, p <0.001), and had longer door-to-balloon times. Only 14 patients (39%) had final diagnoses of acute coronary syndromes, of which 12 were AMI, while 13 (36%) had cardiac diagnoses other than acute coronary syndrome and 9 (25%) had noncardiac diagnoses. Of the patients with AMI, 5 had occluded culprit arteries, of which 2 involved the left anterior descending coronary artery. A Sgarbossa score ≥5 had low sensitivity (14%) but 100% specificity in diagnosing AMI in the presence of new LBBB. In conclusion, new or presumably new LBBB in patients suspected of having AMI identifies a high-risk subgroup, but only a small number have AMI. Two thirds of these patients are discharged from the hospital with alternative diagnoses. The Sgarbossa criteria appear to have limited utility in clinical practice because of their low sensitivity. **(Am J Cardiol 2011;107: 1111–1116)**

Although left bundle branch block (LBBB) is an independent negative prognostic marker in acute myocardial infarction (AMI),[1] the diagnostic accuracy of new or "presumably new" LBBB as an electrocardiographic (ECG) criterion equivalent to ST-segment elevation myocardial infarction (STEMI) in contemporary practice is uncertain. Interpretation of the results of earlier randomized clinical trials has been limited by the use of less sensitive biomarkers of cardiac myonecrosis, and a lack of angiographic data and long-term clinical follow-up.[2,3] We hypothesized that new or presumably new LBBB and the Sgarbossa criteria have limited predictive value for diagnosing AMI. Thus, the aims of this study were to evaluate the frequency, clinical characteristics, and outcomes of patients with new or presumably new LBBB who are suspected of having AMI and to examine the clinical utility of the Sgarbossa criteria in contemporary practice.

Methods

Since 2004, all patients with STEMI at the Mayo Clinic (Rochester, Minnesota) have been prospectively entered in our registry, which includes demographic and clinical data. In-hospital and 1- and 3-month outcomes are prospectively collected by review of the electronic medical records. Details of the Mayo Clinic's STEMI protocol have been published previously.[4] The system of care consists of 28 regional hospitals located up to 150 miles away from Saint Mary's Hospital, a tertiary center with 24-hour primary percutaneous coronary intervention (PCI) facility. All patients presenting to the PCI center are treated with primary PCI. Patients presenting at regional hospitals with STEMI are transferred for primary PCI if symptom duration is >3 hours and immediate transport is available. Patients who are at high clinical risk (such as those with cardiogenic shock or persistent ventricular arrhythmias) or who have contraindications to fibrinolytic therapy are also transferred for primary PCI, regardless of the duration of symptoms. Regional hospital patients with STEMI are treated with fibrinolytic therapy and immediately transferred for a pharmacoinvasive strategy if symptom duration is <3 hours and there are no absolute contraindications to fibrinolysis.

Our study included patients with chest pain or symptoms consistent with AMI in whom initial electrocardiography

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0002-9149/11/$ – see front matter
doi:10.1016/j.amjcard.2010.12.007

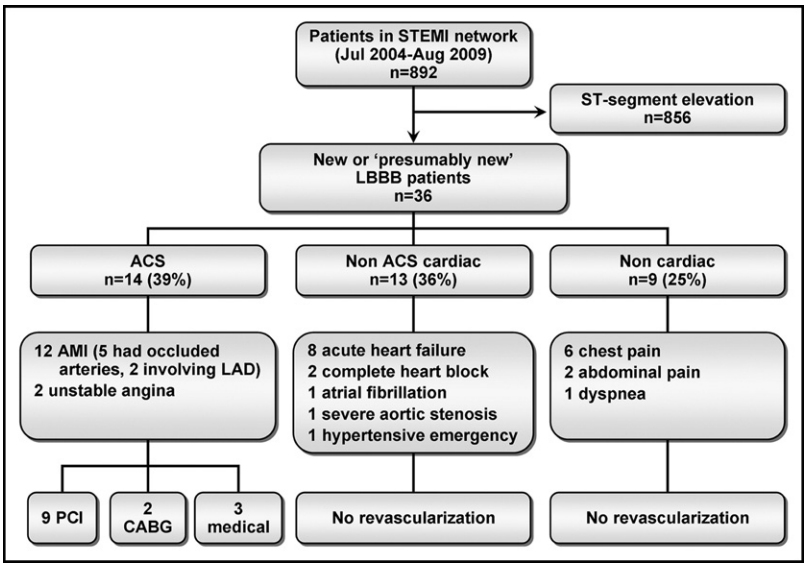

Figure 1. Patient flow chart. CABG = coronary artery bypass grafting.

showed new or presumably new LBBB from July 2004 to August 2009. Patients were excluded if they were previously known to have LBBB or declined authorization for the use of their medical records for research. The study was approved by the Mayo Clinic Institutional Review Board.

The LBBB cohort was divided into 3 subgroups (acute coronary syndromes [ACS], non-ACS cardiac, and noncardiac) according to the final diagnosis at discharge. The validity of the clinical diagnosis was confirmed by review of the medical records, including biomarker profile and angiographic data.

Electrocardiograms were digitally obtained at 100 Hz, at a speed of 25 mm/s and an amplification of 10 mm/mV. All electrocardiograms were independently analyzed by 2 investigators (A.P., H.T.T.), who were blinded to all identifying and other clinical variables. Each electrocardiogram with LBBB was scored according to the Sgarbossa criteria.[5] LBBB was defined as a QRS duration $\geq$0.120 seconds in the presence of a sinus or supraventricular rhythm, a QS or rS complex in lead V_1, and an R-wave peak time $\geq$0.06 seconds in lead I, V_5, or V_6 associated with the absence of a Q wave in the same lead. The following 3 Sgarbossa criteria were evaluated for their diagnostic value in patients with LBBB: (1) ST-segment elevation $>$1 mm concordant with QRS complex (score = 5); (2) ST-segment depression $>$1 mm in lead V_1, V_2; or V_3 (score = 3); and (3) ST-segment elevation $>$5 mm discordant with QRS complex (score = 2).[5]

The clinical characteristics and outcomes of patients with and without LBBB and the 3 LBBB subgroups were compared. Data are presented as mean $\pm$ SD, as median (interquartile range), or as frequencies and percentages. Student's 2-sample *t* tests were used to compare distributions of symmetrical or mildly skewed continuous variables. Mann-Whitney rank-sum tests were used to compare skewed continuous or ordinal variables. Pearson's chi-square tests were used to compare differences in categorical variables. The simple Thrombolysis In Myocardial Infarction (TIMI) risk score was calculated as heart rate $\times$ (age/10)^2/systolic blood pressure.[6] The distributions of right-censored variables such as time to all-cause mortality were estimated using Kaplan-Meier methods and compared to the log-rank statistic. Door-to-balloon (first door-to-balloon for transferred patients) times were right censored at catheterization laboratory arrival in patients in whom PCI was not performed. The ideal cut point for the Sgarbossa criteria was determined by finding the (sensitivity, specificity) pair closest in Euclidean distance to (1, 1), that is, the closest point to perfect sensitivity and specificity.

Results

A total of 892 patients were admitted with initial diagnoses of STEMI for whom the STEMI treatment pathway was initiated. Of these, 36 patients (4%) had new or presumably new LBBB on their presenting electrocardiograms (Figure 1). The clinical characteristics of these patients are listed in Table 1 and are compared to those of patients without LBBB during the same time period. Twenty-two patients were diagnosed at the primary PCI center and 14 patients at a regional hospital and subsequently transferred to the PCI center. Patients with LBBB were older, were less likely to be men, had higher TIMI risk scores, had a higher frequency of congestive heart failure, were less likely to have primary PCI, and had longer door-to-balloon times. Mortality was higher at 3 months in those with LBBB compared to those without LBBB, but this difference was not statistically significant (Figure 2). None of the patients with received fibrinolytic agents.

Of the patients with LBBB, 14 (39%) had final diagnoses of ACS (12 with AMI and 2 with unstable angina), 13 (36%) had cardiac diagnoses other than ACS (8 with acute heart failure, 2 with complete heart block, 1 with atrial fibrillation, 1 with severe calcific aortic stenosis, and 1 with hypertensive emergency), and 9 (25%) were diagnosed with noncardiac chest pain (Figure 1). Table 2 lists the characteristics of these 3 groups.