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Prevalence of acute myocardial infarction in patients with presumably new left bundle-branch block☆

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Abstract

Objectives: We assessed the prevalence of true acute myocardial infarction and the need for emergent revascularization among patients with new or presumably new left bundle branch block (nLBBB) for whom the primary percutaneous coronary intervention protocol was activated.

Methods and Results: Among 802 patients, 69 (8.6%) had nLBBB. The chief presenting symptom was chest pain or cardiac arrest in 36 patients (52.2%) and shortness of breath in 15 (21.7%). Less than 30% of the patients had elevated cardiac troponin-I, and less than 10% had elevated creatine kinase–MB. Only 11.6% of the patients underwent emergent revascularization; the rate was higher for patients who presented with chest pain or cardiac arrest or shortness of breath than for patients who presented with other symptoms.

Conclusions: Acute myocardial infarction and the need for emergent revascularization are relatively uncommon among patients who present with nLBBB, especially when symptoms are atypical. Current guidelines for primary percutaneous coronary intervention protocol activation for nLBBB should be reconsidered.

Keywords: Left bundle branch block; Acute myocardial infarction; Electrocardiogram; Primary percutaneous coronary intervention

Introduction

According to the American College of Cardiology and American Heart Association (ACC/AHA) guidelines, in the absence of contraindications, reperfusion therapy should be administered to patients with symptoms compatible with ST-segment elevation myocardial infarction (STEMI) if these symptoms arose within the prior 12 hours and if an electrocardiogram (ECG) shows new or presumably new left bundle branch block (nLBBB) (level of evidence A).[1] These recommendations stemmed from the Fibrinolytic Therapy Trialists' review of major randomized trials of fibrinolysis versus placebo,[2] which suggested that patients with a bundle branch block had higher baseline mortality and had the greatest incremental improvement in survival when given fibrinolytics. However, in this meta-analysis, right and left bundle branch block were not analyzed separately, nor were known LBBB and nLBBB. Two studies have found that the prognosis of patients with acute myocardial infarction (AMI) and right bundle branch block (especially those with anterior STEMI) is worse than that of patients with LBBB.[3,4] Subsequent analyses by Shlipak et al[5] and Gallagher[6] concluded that treating all patients who have suspected AMI and who present with LBBB (whether it is new or known) with fibrinolytics is preferable to using ECG criteria to diagnose AMI or to determine the age of LBBB.

In 1996, Sgarbossa et al evaluated the ECGs of more than 26, 000 patients in the GUSTO-I (Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) trial and determined that an AMI could be diagnosed by using 3 ECG criteria in patients with known or new LBBB: ST-segment elevation (STE) of ≥1 mm that is concordant with the QRS complex; ST-segment depression of ≥1 mm in lead V_1, V_2, or V_3; and STE of ≥5

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mm that is discordant with the QRS complex.[7] Although the use of these criteria is recommended by the ACC/AHA guidelines,[1] several studies have suggested that the Sgarbossa ECG criteria have low sensitivity but high specificity in the detection of AMI.[5,8-12]

Emergency department physicians, as well as cardiologists, are currently under pressure not to miss STEMI and to shorten the first medical contact-to-balloon time. Activating the catheterization laboratory for patients presenting with typical symptoms and LBBB is reasonable because diagnosing ischemic STE in the presence of LBBB is problematic. However, it is well known that up to a third of patients with AMI present with symptoms other than chest discomfort.[1] Thus, in many cases, the primary percutaneous coronary intervention (pPCI) protocol is activated for patients presenting with nLBBB and symptoms other than typical chest pain, including shortness of breath, nausea, and unexplained hypotension.

The current study had 3 aims: (1) to assess the prevalence of AMI and the need for emergent revascularization among consecutive patients with nLBBB in whom the pPCI protocol was activated; (2) to determine whether presenting symptoms may help in predicting AMI and the need for urgent revascularization among patients with nLBBB; and (3) to assess the validity of the Sgarbossa criteria in our nLBBB patient population.

We used both cardiac troponin I and creatine kinase–MB (CK-MB, >X2 upper limit of normal) for the diagnosing AMI. Cardiac troponin I is more sensitive and specific for AMI than CK-MB. However, we felt that positive cardiac troponin I without significant increase in CK-MB probably represent small AMI that could be more compatible with non ST elevation AMI than STEMI.

Methods

We retrospectively studied consecutive patients admitted to a large, urban hospital in Houston, Texas who had nLBBB on their index ECG and who were considered candidates for primary reperfusion therapy. Patient data were obtained from St. Luke's Episcopal Hospital's pPCI laboratory activation database and included all protocol activations that occurred over a three and a half year period between January 1, 2007, and June 30, 2010. St. Luke's Episcopal Hospital is a tertiary center with a 24-hour cardiac catheterization laboratory. Of 802 consecutive patients, 69 (8.6%) presented with nLBBB (either documented previous ECG without LBBB or no previous ECG in the data base). The physicians at the emergency department have full access to the electronic medical record and ECG database and can easily retrieve previous ECGs, if existing. Patients with known LBBB were excluded. Patients were also excluded if they had right ventricular or biventricular pacing.

Index ECGs were interpreted by 2 readers (NM and YB) who were blinded to patient identities and clinical characteristics. We defined LBBB as meeting all of the following 5 criteria: (1) QRS ≥120 ms in the presence of normal sinus or supraventricular rhythm at presentation; (2) qS or rS complex in lead V_1; (3) Broad notched or slurred R waves in leads V_5 and V_6, or an RS pattern; (4) R peak time >60 ms in leads V_5 and V_6; and (5) absence of a Q wave in leads V_5, V_6, and I.[9,13] The readers also scored the ECGs by using the Sgarbossa algorithm to identify patients at risk for AMI. As previously reported, 5 points were given for an STE >1 mm concordant with the QRS complex, 3 points were given for an ST-segment depression >1 mm in lead V_1, V_2, or V_3, and 3 points were given for an STE >5 mm discordant with QRS complex.[14]

After this initial screening, we reviewed each patient's medical records for relevant clinical data, including chief presenting symptom, baseline clinical characteristics and demographics, outcomes and treatments during the hospital course, and laboratory values. Patients with nLBBB were then subdivided into 3 groups according to whether their chief presenting symptom was chest pain/cardiac arrest, shortness of breath, or a symptom other than these (See Table 3). Clinical characteristics, treatments, clinical outcomes, and laboratory values were then compared among the 3 groups. Peak serum cardiac troponin-I and CK-MB levels were considered elevated if they were greater than the 99th percentile or 2 times greater than the upper limit of the normal range, respectively. All patients in the study had cardiac enzymes drawn in the emergency department on initial presentation followed by serial cardiac enzymes drawn between 6–8 hours apart. High-sensitivity assays were not used to evaluate serum troponin levels at St. Lukes Episcopal Hospital.

Differences among groups were compared by using the chi-square test for discrete variables. $P \leq .05$ was considered statistically significant. We calculated the likelihood ratio for undergoing coronary revascularization based on the presenting symptoms. Likelihood ratio estimates were calculated as sensitivity/(1−specificity).[15]

Results

The baseline characteristics of the 69 patients with nLBBB are shown in Table 1. Most patients with nLBBB had hypertension (69%), and more than one quarter of the patients had diabetes, hyperlipidemia, or a history of coronary heart disease or congestive heart failure.

Of the 69 patients with nLBBB, 19 (28%) had evidence of myocardial necrosis (ie, elevated cardiac troponin-I levels), but only 6 of the 19 patients with evidence of myocardial necrosis (9% of the overall study population) had elevated CK-MB levels. A total of 37 patients (54%) underwent emergent cardiac catheterization after pPCI protocol activation, and additional 7 patients underwent nonemergent cardiac catheterization later in their index admission. Only 8 of the 37 patients (22%) were found to have a culprit epicardial vessel occlusion on emergent cardiac catheterization; 5 of those patients underwent pPCI, and the other 3 underwent coronary artery bypass grafting surgery (Table 2). Although the interventional cardiologist adjudicated the clinical history and ECG findings before