EDITORIAL COMMENT

Left Bundle Branch Block in Acute Myocardial Infarction
Benign or Malignant?*

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Right bundle branch block (RBBB) and left bundle branch block (LBBB) occur commonly in routine electrocardiographic testing, with RBBB often occurring in young patients without apparent organic heart disease, and LBBB more often encountered in older patients with co-existing evidence of organic heart disease and systemic hypertension (1–3). The classic dissections of Lev (4) lent credence to speculation regarding the anatomic pathways associated with the conduction system and their vulnerability to specific anatomical lesions (5,6).

As attention has become focused on the management of individuals with suspected acute coronary insufficiency or infarction, the utility of the electrocardiogram (ECG) as an adjunct to the diagnosis of acute myocardial infarction (AMI) or injury in patients with LBBB has received renewed attention (7–11). Three specific patient settings might be encountered:

1. When the patient has LBBB on admission and recent previous ECGs do not show LBBB, the patient is presumed to have new-onset LBBB, which many investigators and current guidelines accept as the equivalent of electrocardiographic findings supportive of AMI (12,13). The question is raised as to whether it is reasonable to expect that new-onset LBBB in the setting of AMI would have characteristics different from new-onset LBBB in the absence of AMI.

2. When the patient has LBBB on arrival and is known to have LBBB on previous ECGs, the question is raised as to whether the presence or absence of specific characteristics of the LBBB pattern can reliably differentiate between the presence or absence of new injury or infarction.

3. When the patient has LBBB on arrival and no pre-existing ECG is available for comparison, the question arises as to whether there are electrocardiographic characteristics that, if present or absent, could reliably distinguish between patients with new injury or infarction and those without.

Multiple investigators have dealt with aspects of this problem. In a substudy of 681 patients from the Global Utilization of Streptokinase and TPA for Occluded Arteries (GUSTO)-1 and Thrombolysis and Angioplasty in Myocardial Infarction (TAMI)-9 trials, LBBB was encountered in 8% of the patients and thrombolytic therapy was credited with reducing the mortality associated with persistent bundle branch block (both RBBB and LBBB), but persistent block still conferred a higher mortality. Transient block was more common in this study than persistent block, at least in part because of the use of continuous monitoring to detect the presence of bundle branch block (14).

In a much larger review of data from the National Registry of Myocardial Infarction, 6.7% of 297,832 patients had LBBB (n = 19,467), whereas RBBB was almost as common and both were associated with higher rates of co-morbidity and had a worse prognosis in comparison to those without conduction delay. In comparison to patients with ST-segment elevation without bundle branch block, RBBB was a stronger predictor of in-hospital mortality and LBBB was less predictive (15).

Sgarbossa et al. (16) proposed specific electrocardiographic criteria for the diagnosis of AMI in the presence of LBBB based on the criteria performance as applied to 131 patients in the GUSTO-1 trial who had AMI and LBBB in comparison to patients from the Duke database who had LBBB and were clinically stable. The application of the most efficient of the criteria was associated with a high specificity and low sensitivity.

In an evaluation of the previously mentioned criteria in a community-based cohort of 83 patients with 103 presentations of suspected AMI, the criteria proposed by Sgarbossa et al. (16) performed poorly because of a low sensitivity of 10%, although the specificity was high at 82%. The investigators concluded that a sensitivity of 80% and a specificity of 90% would be required for electrocardiographic criteria in the presence of LBBB to be useful in the selection of patients to receive thrombolytic therapy (17).

Citing the overall poor performance of all QRS-based and ST-T-wave based criteria for AMI in the diagnosis of AMI, Maynard et al. (18) propose that body surface mapping be used to improve diagnosis in patients with LBBB; however, both the number of studies and the number of patients involved are very limited.

The report by Wong et al. (19) in the current issue of the Journal presents data to evaluate the Sgarbossa et al. (16) criteria to distinguish between ECGs with LBBB that are indicative of new injury or ischemia and those that are not supportive. The specific measurement criteria are the same as those tested in the previous GUSTO-1 study and are refined and evaluated here in a retrospective analysis of ECGs collected at randomization and 60 min after initia-

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tion of thrombolytic therapy in the Hirulog Early Reperfu-
sion/Occlusion (HERO) trial. The criteria tested include:

1. ST-segment elevation measuring ≥1 mm concordant
   with the QRS in any lead.
2. ST-segment depression measuring ≥1 mm in any of the
   V₁ through V₃ leads.
3. Discordant ST-segment elevation measuring ≥5 mm.

Using a criterion of twice the upper limit of normal value
for serum troponin as the ‘gold standard’ for confirmation
of myocardial injury, the investigators in the Wong et al.
(19) study demonstrate a high specificity for the criteria
of ≥1 mm elevation in any lead or ST-segment depression
in V₁ through V₃, but low sensitivity and low specificity
and sensitivity for ≥5 mm discordant ST-segment ele-
vation in any lead. Because 80% of the 300 patients with
LBBB randomized into the HERO trial had enzymatic
confirmation of AMI (1.76% of 17,013 total patients
enrolled in the HERO trial, all of whom received one of
two comparison regimens of thrombolysis), there will be
some debate as to whether the listed ECG criteria
received an adequate appraisal despite the careful statis-
tical comparisons.

Although the ST-segment elevation criteria identified
patients among those with enzymatically confirmed AMI
who had higher enzymatic levels and worse 30-day mortal-
ity, the low sensitivity indicates that the absence of the
criteria was not useful to exclude enzymatically confirmed
AMI, albeit LBBB patients without ST-segment elevation
had a better 30-day outcome.

A major contribution of this trial—apart from whether or
not the electrocardiographic diagnostic criteria results will
prove to be convincing in other hands and everyday prac-
tice—is the outcome comparisons between patients
with and without LBBB. The overall mortality rates of
patients with LBBB were significantly higher at 30 days
compared to those with normal conduction (16% vs 9.1%, p
< 0.0001), confirming the known higher risk attendant to
the presence of LBBB. However, when patients with LBBB
were compared to an age-matched and geographical origin-
matched internal sample of comparable size with normal
conduction, the 30-day mortality was lower in LBBB
patients (16% vs 22.1%) and the incidence of confirmed
AMI was lower in LBBB patients (80.7% vs 88.7%).
Although the presence of ST-segment changes during
LBBB (versus those with LBBB without ST-segment changes)
was associated with higher mortality (21.7% vs 13.5%, p = 0.067),
the higher mortality rate was not different from matched controls (21.1% vs 25%, p = 0.563),
whereas the mortality was significantly lower in those with
LBBB without ST-segment changes compared with matched controls, respectively (13.5% vs 21.6%, p = 0.022).

Thus, this important trial presents three important find-
ings with major clinical implications:

1. Reliable ECG criteria for acute myocardial injury can
   identify patients with LBBB who are at higher risk for
   increased mortality despite the use of thrombolytic therapy.
2. The LBBB confers increased risk for mortality in the
   setting of suspected AMI; however, the increased risk is
   significantly associated with older age and co-morbidity
   risk factors.
3. In the absence of electrocardiographic criteria for myo-
cardial injury or infarction, AMI patients with LBBB
   may be at lower risk for mortality in comparison to
   age-matched controls, in part possibly due to the “pro-
tective” effect of pre-existing angina.

The findings of the study by Wong et al. (19) warrant
appropriately sized prospective studies to determine the
practicality of the electrocardiographic criteria proposed and
the implications of the matched control findings.

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