Surface ECG: An Acceptable Method for Evaluating LV Function in LBBB Cases

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Abstract

Background- Electrocardiography is one of the oldest, easiest, simplest and most important inexpensive paraclinical tools in cardiology. Being able to use this easy method with enough sensitivity would be a great aid to the cardiologist in evaluating a common problem like congestive heart failure (CHF).

Method- Two hundred cases with left bundle branch block (LBBB) were chosen and divided into two groups: QRS duration less than 120msec in the first group, and more than 120msec in the second group. Left ventricular ejection fraction (LVEF) was studied by 2D, M-mode and Doppler echocardiography as an index of LV systolic function.

Results- In cases with QRS duration less than 120msec, LVEF averaged between 40-50%. In the other group with QRS duration more than or equal 120mseconds, LVEF was between 30-40%. Finally, when QRS duration exceeded 160msec, almost all of the patients had LVEF less than 30%.

Conclusion- LV systolic function could be estimated with an acceptable sensitivity by observing surface ECG in LBBB cases. This observation may lead to conceptual support for attempts at normalizing QRS duration by biventricular or multi-site ventricular pacing in patients with severe LV systolic dysfunction ***(Iranian Heart Journal 2003; 4 (4):31-34).***

Key words: QRS complex duration■ LBBB■ LV function

What is commonly called an electrocardiogram (ECG) is the graph obtained when the electrical potentials of an electrical field originating in the heart are recorded at the body surface.[1,2,4] Recent experimental studies have provided new information capable of expanding the clinical usefulness of the ECG.[3]

It may serve as an independent marker of myocardial diseases, it may reflect anatomic, hemodynamic, molecular, ionic and drug-induced abnormalities of the heart and it may provide information that is essential for the proper diagnosis and treatment of many cardiac problems. In fact it is the most commonly used procedure for the diagnosis of heart disease.[4]

Complete left bundle branch block is a conduction disturbance characterized by wide (>110msec) QRS complexes. The diagnostic criteria consist of prolongation of the QRS complexes (>110mec) with neither a Q nor an S wave in leads I, a VL and properly placed V6. A wide R wave with a notch on its top (plateau) is seen in these leads. Apparently, the electrical axes of most uncomplicated complete LBBBs are not[5,6,7] usually located beyond 30.

Some of the most common conditions with LBBB in ECG are acute and old MI, LV hypertrophy (due to any cause) and ventricular pacing.[1]

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LBBB usually appears in patients with an underlying heart disease. It is associated with significantly reduced long-term survival, with 10-year survival rates as low as 50 percent, probably reflecting the severity of the underlying cardiac disease. Among patients with coronary artery disease, the presence of LBBB correlates with more extensive disease, more severe left ventricular dysfunction and reduced survival rates. [9]

In addition to the hemodynamic abnormalities produced by these underlying conditions, the abnormal ventricular activation pattern of LBBB itself induces hemodynamic perturbations, including abnormal systolic function with dysfunctional contraction patterns.

Reduced ejection fraction, lower stroke volume, abnormal diastolic function, reversed splitting of the second heart sound and functional mitral regurgitation are common. In addition, functional abnormalities in phasic coronary blood flow and reduced coronary flow reserve caused by delayed diastolic relaxation often result in septal or anteroseptal defects on exercise perfusion scintigraphy in the absence of coronary artery disease.[10,11,12]

Patients and Methods

This is a descriptive study, conducted from 2000 to 2002 on 200 cases with LBBB at our center.

First, we observed the prevalence of different etiologies in these cases. Results are shown in Table I. In 75 cases, no obvious cardiac pathology was observed by echocardiography. The most common diagnosis was dilated cardiomyopathy (DCM), followed by myocardial infarction (MI) and hypertension (HTN). Eight cases had valvular heart disease. In the next step, all the patients were divided into two groups based on QRS duration. The first group was comprised of cases with QRS duration more than or equal to 120msec, and the second group consisted of patients with QRS duration less than 120msec. Each group comprised 100 cases. All cases underwent echocardiography with 2D, M-mode and Doppler study at our center. The ejection fraction of LV was calculated as an acceptable index of LV systolic function with M-mode study and Simpson's method in 2-D in the cases with regional wall motion abnormality. LV end-systolic and diastolic dimensions were also obtained with M-mode method.

Table I: Suspected etiologies of LBBB in 200 patients under study.

Etiology	Number
Idiopathic	75
Old MI	35
Hypertension	31
DCM	51
Valvular Disease	8
Total	200

Results

The results of the echocardiographic examinations of the two groups containing LVEF, LV end-diastolic dimension and LV end-systolic dimension, as well as the age of the patients at the time of study and the prevalence of atrial fibrillation were compared in the two groups (Tables II and III). Patients with QRS duration more than or equal to 120msec were older, had lower EF and larger LV cavities.

An analysis of the results with statistical methods showed that QRS duration was correlated positively with age, diastolic dimension and LV end-systolic dimension (P value less than 0.0001). The incidence of AF was 25% in the first group and 5% in the second group (P value of 0.1). It is also obvious that QRS duration is negatively related to LV ejection fraction (P value of less than 0.0001).

Table II: Relative Frequency of Patients with Different LV Ejection Fraction in Two Groups.

QRS	LVEF (%)	PTS
<120	>50	5
	40-50	78
	30-40	15
	<30	--
≥120	>50	2
	40-50	8
	30-40	42
	<30	48*

* 43 patients had QRS≥160 and LVEF<30

Patients Characteristics in Two Groups

Variable	Group 1 QRS≥120 ms (n=100)	Group 2 QRS<120 ms (n=100)	P Value
Age	55±15	50±15	<0.0001
LVEF	30±10	45±10	<0.0001
AF	25%	5%	0.1
LVEDD	65±10	55±10	<0.0001
LVESD	50±10	40±10	<0.0001

Discussion

In these cases with LBBB, regardless of etiology, when QRS duration is increasing toward 160msec, LVEF is simultaneously decreased and when QRS duration is more than 160msec, LVEF is less than 30% almost in all cases with an acceptable statistical value (Fig 1).

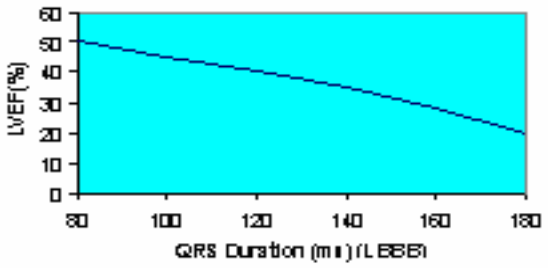

Fig 1: Relationship between QRS duration and LVEF in LBBB cases are shown in this figure. There is a negative relationship between the duration of complex and systolic function of LV.

Thus LV systolic function in patients with LBBB could be estimated by observing the QRS complex duration on surface ECG. Even LBBB patients with QRS duration less than 120msec may be associated with LV systolic dysfunction (Table II).

LBBB with QRS duration more than or equal to 120msec significantly increases the likelihood of low LVEF; furthermore, in patients with QRS duration more than 160msec, LVEF was almost always less than 30%.

This study reemphasizes attempts to normalize QRS duration by biventricular or multi-site ventricular pacing in patients with low cardiac output and also denotes the significant role of QRS duration in the estimation of LVEF by means of a simple and inexpensive method such as the surface ECG.

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