

## PROLONGED QRS DURATION>140 MILLISECONDS AS A PREDICTOR OF LEFT VENTRICULAR SYSTOLIC DYSFUNCTION IN PATIENTS WITH LEFT BUNDLE BRANCH BLOCK

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### Contribution

NA conceived the idea and designed the study. Data collection and manuscript writing was done by NA, GZKN, HT, AA, MSS, MZZ, and IA. All the authors contributed equally to the submitted manuscript.

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### ABSTRACT

**Objective:** To determine the diagnostic accuracy of prolonged QRS duration >140 milliseconds (ms) on electrocardiography (ECG) for diagnosing left ventricular systolic dysfunction (LVSD) in patients of left bundle branch block (LBBB).

**Methodology:** This cross-sectional study included 128 patients with LBBB. QRS duration was calculated in every patient and duration >140ms was considered as positive criterion for predicting LVSD. Echocardiography was done in all patients to diagnose LVSD. Specificity, sensitivity, negative predictive value (NPV) and positive predictive value (PPV) of QRS duration>140 ms on ECG in predicting LVSD taking echocardiography as a standard were calculated by using 2x2 contingency table.

**Results:** An ECG QRS duration>140 ms criterion was 76.3% sensitive and 75.4% specific in diagnosing LVSD while PPV was 72.6% and the NPV of 78.8% in diagnosing LVSD.

**Conclusion:** An ECG QRS duration > 140 ms is reasonable in predicting LVSD.

**Keywords:** Left bundle branch block, left ventricular systolic dysfunction, electrocardiography, echocardiography

## INTRODUCTION

Left bundle branch block (LBBB) is the defect in the electrical conduction of the main left bundle branch. In this condition, left ventricle (LV) contracts after right ventricle due to delayed activation of LV.<sup>1,2</sup> Some patients with LBBB show no cardiac disease on clinical evaluation and echocardiography.<sup>3</sup> It is estimated that about 10% to 36% patients with LBBB may also have left ventricular systolic dysfunction (LVSD).<sup>4</sup> Few studies demonstrate some ECG parameters of LBBB are linked to LV failure and worse outcome but till now no ECG parameter of LBBB has been set to differentiate between patients with and without functional heart problem.<sup>5</sup> Echocardiography (ECHO) is considered as standard to determine functional heart problems.<sup>6</sup>

Some studies have suggested that prolonged QRS duration in patients with LBBB may be a predictor of left ventricular systolic dysfunction (LVSD).<sup>7,8</sup> We conducted this study to ascertain the diagnostic accuracy of QRS duration >140 ms in predicting LVSD, so that in case of reasonable results this simple parameter could be utilized in routine practice for predicting LVSD in patients with LBBB and triage of such patients for further management.

## METHODOLOGY

This cross-sectional study was carried out at Chaudhary Pervaiz Elahi Institute of Cardiology, Multan. Sample size of 128 cases was calculated with 95% of confidence interval and taking expected prevalence of LVSD in LBBB patients of 36.0%<sup>4</sup> with sensitivity of 72.0%<sup>8</sup> and specificity 75.0%<sup>8</sup> of ECG while taking precision level for sensitivity at 13% and specificity at 10%. Consecutive patients with diagnosis of LBBB aging 30-70 years of either gender were included in the study. Patients with diagnosed cardiomyopathies were excluded from the study. Data regarding age, gender, pulse rate, systolic and diastolic blood pressure, diabetes, hypertension, smoking status and body mass index was recorded.

The standard 12-lead ECG was recorded at the time of presentation. All the ECG showing LBBB reported by a senior cardiology resident were evaluated by two consultant cardiologists who unaware of patient's medical history and echocardiographic

findings for presence of LBBB. LBBB was diagnosed on the ECG if QRS duration >120 ms with notched R wave in leads I, avL, V5, and V6, RS pattern in V5 and V6, and absent Q waves in left lateral leads.<sup>2</sup> An ECG criterion of QRS duration >140 ms in patients with LBBB was considered predictive of LVSD.

**Figure 1. ECG of a 51 year old male presented with shortness of breath for first time showing left bundle branch block**

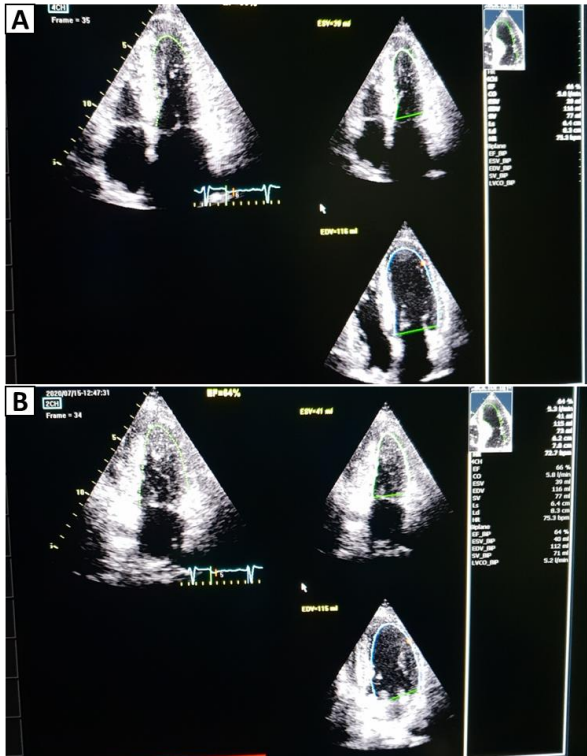


All patients were subjected to transthoracic echocardiography (ECHO) performed on a GE Vivid E9 echocardiographic machine with GE M5S-D probe. Echo was evaluated by two consultant cardiologists who were unaware of patient's medical history and electrocardiographic findings. Left ventricular dimensions and ejection fraction (EF) were measured according to American society of cardiology guidelines. EF less than 50% was considered diagnostic of LVSD as assessed by volumetric bi-plane Simpson's method.

SPSS 20.0 was used to analyze the collected data. A 2x2 contingency table was used to calculate measures of diagnostic accuracy for QRS duration >140 ms taking echocardiography as standard. Frequency and percentages were given for gender distribution, diabetes, hypertension and smoking. Diagnostic accuracy was measured in terms of sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV). Mean and standard deviation was calculated for age, body mass index, pulse, systolic and diastolic blood pressure, end diastolic volume, end systolic volume

and EF for patients with LVSD (EF<50%) and normal LV (LV>50%). Correlation of these variables in patients with LV less than 50% and patients with LV more than 50 % was tested with Pearson correlation coefficient. A p value below 0.05 was considered statistically significant.

**Figure 2: Biplane Simpson Method for calculation of EF a) in apical 4 chamber view b) in apical 2 chamber view**



## RESULTS

A total of 128 patients were included in the study. Mean age of patients was 51.94±9.11 years including 68.75% (n=88) females and 31.25% (n=40) males. There were 49 (38.28%) patients with hypertension, 48 (37.50%) patients having diabetes mellitus and 48 (37.50%) smoker patients in this study.

**Table1: Shows sensitivity, specificity, PPV and NPV of QRS duration >140 ms in predicting LVSD**

LVSD on ECG	LVSD ON ECHO		Total
	Yes	No	
Yes	35.2% (45)	13.3% (17)	48.4% (62)
No	10.9% (14)	40.6% (52)	51.6% (66)
<b>Total</b>	<b>46.1% (59)</b>	<b>53.9% (69)</b>	<b>100% (128)</b>

Sensitivity = 76.3%, Specificity = 75.4%, Positive Predictive Value (PPV) = 72.6%, Negative Predictive Value (NPV) = 78.8%

Table 2 shows the clinical, electrocardiographic and echocardiographic characteristics of patients with LV ejection fraction more than 50% and less than 50%.

**Table 2: Demographic, clinical, ECG and echocardiographic parameters**

Parameters	LVEF>50%	LVEF<50%	P-Value
<b>Total (N)</b>	<b>69</b>	<b>59</b>	-
Age (years)	50.61±8.99	53.77±9.02	0.5
Gender			
Male	37.7% (26)	23.7% (14)	<0.005
Female	62.3% (43)	76.3% (45)	
BMI (kg/m <sup>2</sup> )	30.21±4.32	28.76±5.87	0.8
Pulse (bpm)	79±12	82±14	0.5
Systolic blood pressure (mmHg)	135±11	104±8	<0.05
Diastolic blood pressure (mmHg)	84±8	70±9	<0.05
Mean QRS duration on ECG (ms)	132±10	159±22	<0.001
End diastolic volume (ml)	101.6±38.6	149±57.4	<0.001
End systolic volume (ml)	38±19	49±13	<0.001
Mean Ejection Fraction (%)	56±4 %	31±6%	<0.001

## DISCUSSION

Framingham study has shown that changes in QRS duration is an important factor in determining cardiac diseases. Patients with LBBB commonly have underlying cardiac disease. LBBB is also associated with increased cardiac morbidity and mortality. The lifetime risk for developing LBBB is around 0.7% in healthy subjects.<sup>9-12</sup> LBBB is a bad prognostic sign linked with increased morbidity and mortality in patients with LV failure.<sup>13</sup> LBBB also causes electro-mechanical dissociation resulting in LV dysfunction and negative remodeling.<sup>14</sup>

The QRS duration has been shown to be associated with LVSD and baseline LBBB has been linked with poor LV function.<sup>14</sup> In our study QRS duration >140 ms was set as the cut-off value in patients with LBBB for the diagnosis of LVSD. Our study showed that the QRS duration is a good ECG parameter for predicting LVSD in patients with LBBB. We have found that by keeping QRS duration > 140ms in patients with LBBB has sensitivity of 76.3% and specificity of 75.4% in predicting LVSD on ECG. Deniz et al showed comparable results to our study by reporting that QRS duration >140 ms is 72% sensitive and 75% specific in diagnosing LVSD.<sup>8</sup> Das et al set QRS duration > 170 ms on ECG and showed that it is a predictor of LVSD.<sup>6,15</sup> However in that study the authors did not calculate the sensitivity and specificity of this parameter in determining LVSD.<sup>6,15</sup> Secondly that study set QRS duration >170 ms to label LVSD while we kept it >140 ms. Our study has shown that QRS duration >140ms can predict LVSD and it could be a cheap parameter that can predict LVSD and can help in the further management of such patients.

The limitation of our study is that it is a single center cross sectional study that included patients with LBBB. Also some patients with LBBB having normal EF may develop LVSD later in life that can be observed in the follow-up, but which could not be diagnosed by echocardiography at the time of this study.

## CONCLUSION

The QRS duration >140 ms in LBBB has reasonable diagnostic accuracy in predicting LVSD.

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