

## RELATION OF LEFT BUNDLE BRANCH BLOCK IN TYPE 2 DIABETES MELLITUS WITH LEFT VENTRICULAR SYSTOLIC FUNCTION AND HEMOGLOBIN A<sub>1c</sub>

M. Saravi<sup>1</sup>, M.T. Salehi Omran<sup>2</sup>, S.B. Ashrafvaghefi<sup>3</sup>

*Key words: diabetes mellitus, left bundle branch  
block, heart failure*

### SUMMARY

*The aim of the study was evaluation of left bundle branch block (LBBB) as a marker of cardiovascular involvement in diabetes mellitus (DM) patients by examining left ventricular systolic function and hemoglobin A<sub>1c</sub>. Data on 25 DM patients with LBBB were compared with data on 25 DM patients without LBBB and 25 non-DM patients with LBBB. The mean age of patients in DM with LBBB, DM without LBBB, and non-DM with LBBB groups was 62.2±9.4, 62±6.3 and 63.6±8 years, respectively (p=NS). There were 72%, 65/4% and 50% of female patients, respectively (p=NS). Left ventricular ejection fraction in DM with LBBB was significantly lower than in DM without LBBB and non-DM with LBBB (32.8±10.8 vs. 58.9±7.7 and 41±12; p<0.002). Left ventricular end-diastolic diameter was significantly higher in DM with LBBB than in DM without LBBB and non-DM with LBBB (61.6±7.1 vs. 50.6±3.7 and 58±10.1 mm;*

*p<0.01). There was also a significant difference in left atrial size (46.6±7.8 mm in DM with LBBB vs. 35.7±2.4 mm in DM without LBBB vs. 42±7.5 mm in non-DM with LBBB; p<0.02). However, there was no significant difference in HbA<sub>1c</sub> levels between DM with LBBB and DM without LBBB patients (7.80%±2.03 vs. 7.08±1.51; p=NS). LBBB in DM patients is associated with a more advanced cardiovascular involvement and more severe left ventricular systolic dysfunction as compared with both DM patients without LBBB and non-DM patients with LBBB.*

### INTRODUCTION

Diabetes mellitus (DM) is a common (1) metabolic disorder principally characterized by elevated blood glucose levels, and as a major risk factor (2,3) by microvascular and macrovascular complications that considerably increase the morbidity and mortality related to the disease, hence reducing the quality of life (4).

The existence of a 'diabetic cardiomyopathy' has been proposed in view of a substantially increased lifetime risk of congestive heart failure (CHF) in patients with diabetes (5,6).

Correspondence to: M. Saravi, MD, PhD, Department of Pacemaker and Electrophysiology, Rajaie Cardiovascular Medical and Research Center, Iran University of Medical Sciences, Mellat Park, Vali-E-Asr Avenue, POB 15475-1341, Tehran, Iran  
E-mail: mehrdadsaravi@gmail.com

Left bundle branch block (LBBB) is described as prolongation (by more than 120 ms) of QRS duration and therefore asynchrony is visible on electrocardiogram as an index of increased morbidity (7,8). Patients with DM had involvement of conduction system like bundle branch block, QT interval abnormalities and autonomic neuropathy (1).

Hemoglobin A<sub>1c</sub> (HbA<sub>1c</sub>) concentration is an indicator of average blood glucose concentrations over the preceding 3 months; it is useful for characterizing dysglycemia in population studies because it is simpler to perform than the oral glucose tolerance test. The increased risks for diabetes seemed to be mediated almost entirely through HbA<sub>1c</sub> (9).

On these grounds, the aim of the present study was evaluation of LBBB as a determinant factor for both normal and impaired global left ventricular (LV) systolic function in patients with DM type 2, and comparison with LBBB in non-DM patients and DM 2 patients without LBBB as well as their relations to HbA<sub>1c</sub>.

## MATERIAL AND METHODS

Data on 25 diabetic patients with left bundle branch block (DM with LBBB) were compared with data on 25 diabetic patients without left bundle branch block (DM without LBBB) and 25 nondiabetic patients with left bundle branch block (non-DM with LBBB). The inclusion criteria were age >45 years and DM type 2 of >5 years. Matched controls were selected who were nondiabetic but had left bundle branch block (non-DM with LBBB). Age, sex, race, hypertension and coronary artery disease were matched among three groups. Hypertension was defined as a history of hypertension or use of antihypertensive medications. Coronary artery disease was defined as a history of myocardial infarction, angina pectoris with positive stress rest, or coronary angiography showing a decrease in lumen diameter of >50% in one or more of the major epicardial coronary arteries or their primary branches. Echocardiography was done as part of the protocol. The echocardiographic left ventricular ejection fraction (modified Simpson's method; LVEF), left ventricular end-systolic diameter (LVESD), left

ventricular end-diastolic diameter (LVEDD) and left atrial diameter (LAD) were recorded and compared among groups. Laboratory data on HbA<sub>1c</sub> were recorded in all patients.

Continuous variables were expressed as mean and analyzed by Student's t-test. Categorical variables were expressed as percentage and analyzed by  $\chi^2$ -test or Fisher's exact test as appropriate. A two-tailed p value of 0.05 or less was considered significant. All statistical analyses were performed using the SPSS 15.0 (SPSS Inc., Chicago, IL) software.

## RESULTS

The mean age of patients in DM with LBBB, DM without LBBB, and non-DM with LBBB groups was 62.2±9.4, 62±6.3 and 63.6±8 years, respectively (p=NS). There were 72%, 65.4% and 50% of female patients in DM with LBBB, DM without LBBB and non-DM with LBBB group, respectively (p=NS). LVEF was significantly lower in DM with LBBB patients than in DM without LBBB and non-DM with LBBB patients (32.8±10.8 vs. 58.9±7.7 and 41±12; p<0.002). LVEDD was significantly higher in DM with LBBB patients than in DM without LBBB and non-DM with LBBB patients (61.6±7.1 mm vs. 50.6±3.7 mm and 58±10.1 mm; p<0.01). A significant difference was also recorded in left atrial size (46.6±7.8 mm in DM with LBBB vs. 35.7±2.4 mm in

Figure 1. Correlation between LVESD and age in LBBB group.

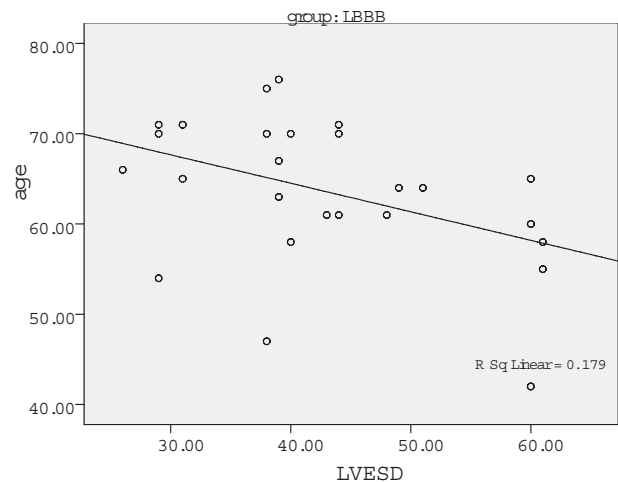


Table 1. Data on diabetic patients with left bundle branch block (LBBB, group 1) versus diabetic patients without left bundle branch block (group 2) and non-diabetic patients with left bundle branch block (group 3)

Variable	Group	Mean ± SD	p	p groups 1-2	p groups 1-3	p groups 2-3
Age (yrs)	DM + LBBB	62.2±9.4	0.812*	0.982*	0.806*	0.896*
	DM	62.6±6.3				
	LBBB	63.6±8				
BMI (kg/m <sup>2</sup> )	DM + LBBB	30.45±4.61	0.519*	0.662*	0.524*	0.973*
	DM	29.23±4.16				
	LBBB	28.92±5.95				
DM duration (yrs)	DM + LBBB	12.96±4.59	0.058*		Not applicable	
	DM	10.48±4.46				
	LBBB	7.80±2.03				
HbA <sub>1c</sub>	DM + LBBB	7.08±1.51	0.215*		Not applicable	
	DM	7.08±1.51				
	LBBB	3.68±0.52				
LVEDD	DM + LBBB	61.6±7.1	0.01	0.015	0.215*	0.02
	DM	50.6±3.7				
	LBBB	58±10.1				
LVEDV	DM + LBBB	268.9±55.2	0.01	0.021	0.052*	0.02
	DM	146.5±40.3				
	LBBB	232.2±64.2				
LVESD	DM + LBBB	47.6±7.5	0.03	0.017	0.073*	0.04
	DM	33.3±3.2				
	LBBB	42.7±10.8				
LVESV	DM + LBBB	165.9±41.9	0.03	0.01	0.024	0.04
	DM	69.8±30.9				
	LBBB	137.4±49.1				
EF	DM + LBBB	32.8±10.8	0.002	0.015	0.017	0.03
	DM	58.9±7.7				
	LBBB	41±12				
LAD	DM + LBBB	46.6±7.8	0.02	0.02	0.039	0.001
	DM	35.7±2.4				
	LBBB	42±7.5				

\*non-significant

DM without LBBB vs. 42±7.5 mm in non-DM with LBBB; p=0.02). However, there was no significant difference in HbA<sub>1c</sub> levels between DM with LBBB and DM without LBBB patients (7.80%±2.03 vs. 7.08±1.51; p=0.02) (Table 1). LVESD in DM without LBBB and non-DM with LBBB showed statistical significance with age.

A statistically significant correlation was found only between LVESD and age in patients with DM and LBBB (Fig. 1).

## DISCUSSION

Diabetes mellitus, a disease that has been reaching epidemic proportions (10), is an important risk factor for the development of cardiovascular complications (11,12). The World Health Organization estimates that

over 300 million people will suffer from DM by the year 2025 (13). DM increases the risk of heart failure even independently of underlying coronary artery disease, and many believe that diabetes leads to cardiomyopathy (14). Diabetes remains an independent predictor of congestive heart failure and of mortality among patients with congestive heart failure (15).

The occurrence of bundle branch block (BBB) is not a benign condition. A higher mortality rate in patients with BBB was found in the Framingham study (16). LBBB is commonly associated with dilated cardiomyopathy (11,17).

An increased risk of death and cardiovascular abnormalities in patients with LBBB was found to be independent of other comorbid conditions in a study of 5517 patients (7).

HbA<sub>1c</sub> concentration is an indicator of average blood glucose concentrations over the preceding 3 months (18). The relationship between HbA<sub>1c</sub> and cardiovascular disease, and between HbA<sub>1c</sub> and all-cause mortality was found to be continuous and significant (11).

We studied LBBB and left ventricular size and function in diabetic patients by selecting diabetic patients with LBBB and comparing their echocardiographic findings with diabetic patients without LBBB and nondiabetic patients with LBBB. Interestingly, we found that patients with both LBBB and DM had a more severe left ventricular dysfunction compared to diabetic patients without LBBB and nondiabetic patients with LBBB; all groups were matched for comorbid conditions, age, race and sex. These patients had a higher serum level of HbA<sub>1c</sub>.

Many studies of LBBB have concluded that LBBB is associated with advanced cardiac disease and poor prognosis (19-24); depressed myocardial systolic and diastolic function is due to an abnormal sequence of left ventricular activation. Several recent studies have suggested that cardiac resynchronization can improve cardiac function, enhance the quality of life and reduce the all-cause mortality (25). LBBB in DM associated with severe left ventricular dysfunction may reflect diffuse involvement of the left ventricle in DM (26-28).

Our study also showed that there were no significant differences in HbA<sub>1c</sub> levels between DM with LBBB and DM without LBBB. We demonstrated the presence of LBBB in diabetic patients to be associated with a more severe left ventricular dysfunction.

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