

Coronary angiographic and Echocardiographic findings in patients with Left bundle branch block

Mohammed Younes Naji Al Atbee¹, Sarkis K. Strak², Abd-Alumeer Abdulbari³,
Hasan Mohammed Al Rubaie⁴

ABSTRACT

Background and Objectives: Left bundle branch block is an electrical conduction disturbance that can be present with various cardiovascular diseases. Atherosclerosis is the most frequent underlying cause of ischemic heart disease with left bundle branch block. This study was carried out to analyze the angiographic and echocardiographic findings in patients with left bundle branch block. Left ventricular systolic function had also been assessed and correlated with measured QRS width and angiographic findings.

Methods: A total of 100 patients with left bundle branch block, 66 males and 34 females, with a ratio of about 2:1 with an age ranged from 30-75years (mean age 58.5 ± 8.1 years). The study was conducted in Al-Sadr teaching hospital in Basrah, South of Iraq during the period from January 2009 to April 2010. Echocardiography was done for all patients to assess left ventricular function and regional wall motion abnormalities, Left ventricular systolic dysfunction was considered if the ejection fraction was less than 50%. The QRS width recorded from the ECG was calculated, and compared with echocardiographic and coronary angiographic findings. Coronary angiography was performed to define coronary lesions for all patients.

Results: Fifty seven percent of patients had left bundle branch block of ischaemic origin and forty three percent of non ischaemic left bundle branch block. The predictors of ischaemic left bundle branch block were male, age older than 50 years, diabetes mellitus, and regional wall motion abnormalities. The QRS complex width as recorded from the ECG was predictor of left ventricular systolic dysfunction irrespective of other risk factors.

Conclusion: Left bundle branch block was correlated with more extensive coronary heart disease and severe left ventricular dysfunction as studied by ECG, echocardiography and coronary angiography.

Key words: angiography, LBBB, Basrah

نتائج قسطرة الشرايين التاجية وجهاز صدى القلب للمرضى المصابين بانسداد الحزمة الكهربائية اليسرى في القلب الخلفية والأهداف: انسداد الحزمة الكهربائية اليسرى في القلب هو اضطراب في التوصيل الكهربائي الذي يُمكن أن يتسبب أمراض الأوعية القلبية المُختلفة. ويعد تصلب الشرايين العصادي المصحوبة بانسداد الحزمة الكهربائية اليسرى السبب الشائع الرئيس لأمراض الأوعية التاجية ألقفارية. هذه الدراسة نُفذت لتحليل نتائج تلوين الشرايين ألتاجية وجهاز صدى القلب لمرضى انسداد الحزمة الكهربائية اليسرى في القلب. كما تم تقييم الوظيفة الانقباضية للبطين الايسر أيضاً وقورنت مع قياس عرض موجة (كيو، آر، إس) و نتائج تلوين شرايين القلب ألتاجية. الطرق: شملت هذه الدراسة ١٠٠ مريض من مرضى انسداد الحزمة الكهربائية اليسرى في القلب ٦٦ ذكر و ٣٤ أنثى بنسبة حوالي ٢:١ ، وبمُمر يتراوح من ٣٠-٧٥ سنة (متوسط العمر 58.5 ± 8.1 سنوات) والذين أُحيلوا لفحص تلوين الشرايين ألتاجية في مستشفى الصدر التعليمي في البصرة، جنوب العراق حيث تمت الدراسة بين يناير/كانون الثاني ٢٠٠٩ وأبريل/نيسان ٢٠١٠. وقد اجري جهاز صدى القلب لكُل المريض لتقييم وظيفة البطين الايسر وحالات شذوذ حركة الجدار الموضعي للقلب. واعتبر عطل الوظيفة الانقباضية للبطين الايسر موجوداً إذا كان الجزء الانقباضي

¹FICMs(med.), CABMS(nephro), ²FRCP., FRCPI, ³CABMS, FICMS, FICMS(cardiology) & ⁴MD(cardiology)

Department of Medicine/University of Basrah college of medicine: drabd7@gmail.com

Cardiology unit/Al Sader Teaching Hospital

أقل من ٥٠%. وحسب عرض موجة (كيو، آر، إس) و سجل وقورن مع نتائج جهاز صدى القلب و نتائج تلوين الشرايين ألتاجية . وأجري تلوين الشرايين ألتاجية لكُلّ المرضى لغرض تحديد الأفات ألتاجية.

النتائج: سبعة وخمسون بالمائة من المرضى كان عندهم انسداد الحزمة الكهربائية اليسرى في القلب لسبب إقفاري وثلاثة وأربعون بالمائة لا سباب غير إقفاري. يمكن التنبؤ انسداد الحزمة الكهربائية اليسرى في القلب لإقفارية اذا كان المريض ذكراً أو عنده تقدم السن أكثر من ٥٠ سنة أوفي حالة داء السكري أو حالات شذوذ حركة الجدار الموضعي للقلب. أما عرض موجة (كيو، آر، إس) المسجلة من جهاز تخطيط القلب فأنها يمكن ان تنبأ بعطل الوظيفة الإنقباضية للبطين الايسر بشكل مستقل عن وجود أو غياب عوامل الخطورة.

الإستنتاج: بينت هذه الدراسة بأن مرضى انسداد الحزمة الكهربائية اليسرى في القلب لهم ارتباط بأمراض الأوعية القلبية الشاملة و يعطل وظيفة البطين الايسر الشديد كما ظهر ذلك بواسطة جهاز تخطيط القلب، جهاز صدى القلب وتلوين الشرايين ألتاجية.

INTRODUCTION

Left bundle branch block (LBBB) is an electrical conduction disturbance that can be present both in healthy patients and patients with various cardiovascular diseases.^[1] LBBB is often a marker of one of four underlying conditions associated with increased risk of cardiovascular morbidity and mortality: coronary heart disease (frequently with impaired left ventricular function), hypertensive heart disease, aortic valve disease, and cardiomyopathy.^[2] LBBB usually appears in patients with underlying heart disease, although as many as 12 percent of patients with LBBB have no demonstrable heart disease.^[3] Even among persons without overt heart disease, LBBB is associated with a higher than normal risk of cardiovascular and all causes of mortality.^[4] It is associated with substantially higher than expected risks of high-grade atrioventricular block and cardiac death, mostly as a result of sudden death outside the hospital setting.^[5] Among patients with coronary artery disease, the presence of LBBB correlates with more extensive disease, more severe left ventricular dysfunction, and reduced survival rates. In addition to the hemodynamic abnormalities produced by the underlying cardiovascular conditions, the abnormal ventricular activation pattern of LBBB itself induces hemodynamic changes. These include abnormal systolic function with dysfunctional contraction patterns, reduced ejection fraction and lower stroke volumes, and abnormal

diastolic function,^[6] which may represent a form of cardiomyopathy.^[7] In addition, functional abnormalities in phasic coronary blood flow often result in septal or anteroseptal defects on exercise perfusion scintigraphy in the absence of coronary artery disease.^[8] Invasive assessment of coronary arteries by means of conventional coronary angiography in the presence of LBBB is a gold standard in detecting myocardial ischaemia, although it is related to high costs but risks of serious and life threatening complications can be prevented.^[9] Coronary heart disease with normal or patent coronary circulation by angiography has been documented. The overall prevalence rate of ischemic heart disease with normal angiogram is low and various mechanism have been hypothesized including coronary spasm, coagulation disorders, and embolizations.^[10] Coronary angiography remains the 'gold standard' for identifying the presence or absence of stenosis due to coronary artery disease and provide the most reliable anatomical information for determining the appropriateness of medical therapy, percutaneous coronary intervention, or coronary artery bypass graft in patients with ischemic heart disease.^[11] This study was carried out to analyze the angiographic and echocardiographic findings in patients with left bundle branch block. Left ventricular systolic function had also been assessed and correlated with measured QRS width and angiographic findings.

PATIENTS AND METHODS

This is a cross sectional study, a total of 100 patients with LBBB, 66 males and 34 females with an age ranged from 30-75 years (mean age 58.5 ± 8.1 years) were referred for coronary angiographic examination. The study was conducted in Al-Sadr teaching hospital during the period from January 2009 to April 2010. Written informed consent was obtained from all patients. LBBB was confirmed by electrocardiography (ECG). The QRS width was calculated, and compared with echocardiographic and coronary angiographic findings. The diagnostic criteria for complete Left Bundle Branch Block were^[12]

1. QRS duration ≥ 120 msec.
2. Broad, notched R waves in lateral precordial leads (V_5 and V_6) and usually leads I and aVL.
3. Small or absent initial r waves in right precordial leads (V_1 and V_2) followed by deep S waves.
4. Absent septal q waves in left-sided leads.

Echocardiography was done for all patients to assess left ventricular function (LV) function and regional wall motion abnormalities which were correlated with coronary angiographic findings, left ventricular systolic dysfunction was considered if the ejection fraction (EF) was less than 50%.^[25] The ejection fraction (EF) calculated by M-mode tracing is obtained by placing the cursor just beyond the tips of the mitral valve leaflets in 2D-echocardiographic para-sternal long-axis view which is automatically calculated by the software system. Patients with left ventricular outflow obstruction, aortic stenosis and hypertrophic cardiomyopathy were excluded from the study. Preliminary evaluation of all patients included the clinical characteristics of the patients' age, gender, smoking, systemic hypertension and diabetes mellitus which were all correlated with angiographic findings. Hypertension and diabetes mellitus were considered if blood pressure was equal or more than 140/90^[23] and if fasting plasma sugar was more than 126 mg/dl.^[24] Current smoking was considered to

be present if the patient had smoked everyday within the previous month.^[13] Coronary angiography was performed by the Seldingers technique and visually analyzed by a cardiologist. The degree of luminal narrowing was recorded in percentage of prestenotic diameter. Critical coronary lesion was considered to be present if there was at least 70% reduction in the diameter of a major epicardial coronary artery as right coronary artery (RCA), left circumflex artery (LCx), left anterior descending artery (LAD) or at least 40% reduction in the diameter of left main stem artery (LMS). Angiography was considered as normal when the test did not identify any obstruction of any major epicardial coronary artery. The numbers of critical coronary vessels involved were recorded, accordingly, the patients were classified into those who had single, two, three and four vessels disease. Data were coded and fed on computer. Analysis was done on SPSS version 15, for determination of statistical significance among different variables. A descriptive statistics like mean together with analytic statistics, have been done when appropriate. A p-value of less than 0.05 was considered as significant.

RESULTS

This study comprised 100 patients with LBBB. Fifty four (54%) patients were hypertensive, 40(40%) diabetics and 30(30%) were smokers. Three of 43 patients with non ischaemic LBBB enrolled in this study had no risk factors, echocardiographic abnormalities or coronary artery disease. The frequency of patients who had LBBB of ischaemic origin was 57(57%) and of non ischaemic LBBB was 43(43%). The frequency of ischaemic LBBB was more among male patients 42 (63.4%); P-value = 0.03 and among age group older than 50 years 40 (63.7%); P value = 0.01, these were statistically significant which related to normal versus abnormal coronary angiography, (Table-1).

Table 1. Age and sex distribution and angiographic findings in studied patients.

	Ischaemic lbbb (with CHD)					Non ischaemic LBBB Normal coronary angiography (%)	Total (%)	P-value
	Single vessel disease (%)	Two vessel disease (%)	Three vessel disease (%)	Left main stem & three vessel disease (%)	Total (%)			
Male	6 (9.1)	10 (15.2)	15 (22.7)	11 (16.7)	42 (63.7)	24 (36.3)	66 (100)	0.03
Female	7 (20.6)	5 (14.7)	2 (5.9)	1 (2.9)	15 (44.1)	19 (55.9)	34 (100)	
Total	13 (13)	15 (15)	17 (17)	12 (12)	57 (57)	43 (43)	100 (100)	
< 50 Years	5 (13.5)	4 (10.8)	5 (13.5)	3 (8.1)	17 (45.9)	20 (54.1)	37 (100)	0.01
> 50 Years	8 (12.7)	11 (17.5)	12 (19)	9 (14.3)	40 (63.5)	23 (36.5)	63 (100)	
Total	13 (13)	15 (15)	17 (17)	12 (12)	57 (57)	43 (43)	100 (100)	

An increased incidence of LV systolic dysfunction was seen among patients with increasing QRS width of more than 140 ms (72.7%) as compared with patients with QRS width between 120-139 ms, these difference were statistically significant (P= 0.044), (Table-2).

Table 2. Distribution of QRS complex width of studied patients and LV systolic function.

Width of QRS	Left ventricular function (EF%)		Total (%)
	Normal (EF > 50) (%)	LV Dysfunction (EF<50) (%)	
120-139 ms	21 (46.7)	24 (53.3)	45 (100)
>140 ms	15 (27.3)	40 (72.7)	55 (100)
Total	36 (36)	64 (64)	100 (100)
P = 0.044			

There were increased incidence of regional wall motion abnormalities 34 (61.8%) and global LV wall hypokinesia 21(38.2%) as studied by echocardiography in those with width of QRS complex of more than 140 ms as compared in those with QRS complex width between 120-139 ms and these differences were statistically significant (P=0.022), (Table-3).

Table 3. Distribution of QRS complex width and regional wall motion abnormalities.

Width of QRS	Regional wall motion abnormalities		Global LV wall hypokinesia (%)	Total (%)
	No. (%)	Yes (%)		
120-139 ms	5 (11.2)	29 (64.4)	11 (24.4)	45 (100)
>140 ms	0 (0)	34 (61.8)	21 (38.2)	55 (100)
Total	5 (5)	63 (63)	32 (32)	100 (100)
P = 0.022				

No statistically significant differences were found between ischaemic and non ischaemic LBBB in those with different QRS width measurement (P = 0.7). An increased incidence of LV systolic dysfunction was seen among studied patients with regional wall motion

abnormalities and global LV wall hypokinesia 33(52.4%), 31(96.9%) respectively as compared with patients with normal LV systolic function. The differences were statistically significant (P = 0.001), (Table-4).

Table 4. Relation of regional wall motion abnormalities and LV systolic function.

		Left ventricular function (EF%)		Total (%)
		Normal (EF>50) (%)	LV Dysfunction (EF<50%) (%)	
Regional Wall motion abnormalities	No.	5 (100)	0 (0)	5 (100)
	Yes	30 (47.6)	33 (52.4)	63 (100)
Global LV wall hypokinesia		1 (3.1)	31 (96.9)	32 (100)
Total		36 (36)	64 (64)	100 (100)
P = 0.001				

There were significant differences between ischaemic and non ischaemic LBBB in those with echocardiographic evidence of regional wall motion abnormalities 41(65%) and 22(35%) respectively. These were statistically

significant (P = 0.04). There were no significant differences between ischaemic and non ischaemic LBBB in those with global LV wall hypokinesia, (Table-5).

Table 5. Relationship of Echocardiographic finding of regional wall motion abnormalities and angiographic findings in studied patients

		Ischaemic LBBB (with CHD)					Non ischaemic LBBB {Normal coronary angiography} (%)	Total (%)	P value
		Single vessel disease (%)	Two vessel disease (%)	Three vessel disease (%)	Left main stem & three vessel disease (%)	Total (%)			
Regional Wall motion abnormalities	No.	1 (20)	0 (0)	0 (0)	0 (0)	1 (20)	4 (80)	5 (100)	0.04
	Yes	10 (15.9)	14 (22.2)	13 (20.6)	4 (6.3)	41 (65)	22 (35)	63 (100)	
Global LV wall hypokinesia		2 (6.3)	1 (3.1)	4 (12.5)	8 (25)	15 (46.9)	17 (53.1)	32 (100)	0.13
Total		13 (13)	15 (15)	17 (17)	12 (12)	57 (57)	43 (43)	100 (100)	

No differences were found between ischaemic and non ischaemic LBBB in those with normal or abnormal LV function (Table-6).

Table 6. Distribution of LV systolic function and Angiographic findings in studied patients.

LV function	<i>Ischaemic LBBB (with CHD)</i>					<i>Non ischaemic LBBB { Normal coronary angiography (%) }</i>	Total (%)	P value
	Single vessel disease (%)	Two vessel disease (%)	Three vessel disease (%)	Left main stem & three vessel disease (%)	Total (%)			
Normal (EF>50)	7 (19.2%)	6 (16.7%)	5 (13.9%)	1 (2.8%)	19 (52.8%)	17 (47.2%)	36 (100%)	0.5
LV Dysfunction (EF<50%)	6 (9.4%)	9 (14.1%)	12 (18.8%)	11 (17.2%)	38 (59.4%)	26 (40.6%)	64 (100%)	
Total	13 (13%)	15 (15%)	17 (17%)	12 (12%)	57 (57%)	43 (43%)	100 (100%)	

DISCUSSION

Patients with LBBB and concomitant coronary heart disease (CHD) have a worse prognosis than those with LBBB without coronary heart disease (CHD).^[14] In the Framingham study, patients with LBBB who were followed, had increased mortality as compared with those without LBBB, but this worsened survival was observed only in those with concomitant CHD. Patients with LBBB and no CHD had reasonably good prognosis.^[1] In this study 57(57%) patients with LBBB had CHD as compared with 43(43%) patients with LBBB with no CHD. Out of these 43 patients, 3(7%), all females had no risk factors, echocardiographic or angiographic abnormalities, possibly due to microangiopathic ischaemia or underlying congenital electrical heart defect. Other study^[3] had shown that 12% of their patients had no risk factors, echocardiographic or angiographic findings. Forty (63.7%) of the studied patients were older than 50 years, 32(50.8%) of them had multivessel disease (more than one vessel) as compared to those below 50 years 12(32.4%) had multivessel disease. Similar results were seen in Ghaffari et al study,^[15] this is because

the age is the most powerful independent risk factor for atherosclerosis. Pre-menopausal women have much lower rates of disease than age and risk-matched males; however, the gender difference disappears rapidly after the menopause.^[16] There were increased incidence of LV dysfunction among patients with regional wall motion abnormalities and global LV wall hypokinesia, and also more ischaemic LBBB in those with echocardiographic evidence of regional wall motion abnormalities. The above results could be explained by, that coronary heart disease causes 'akinetic' or 'dyskinetic' segments of myocardial muscle which contract poorly and may impede the function of the normal segments thus distorting their contraction and relaxation patterns which lead to segmental dysfunction and reduced ventricular contractility thereby LV systolic dysfunction.^[22] No differences were found between ischaemic and non ischaemic LBBB in those with LV systolic dysfunction which were agreed with *Hayat S.A. et al* study,^[17] however, other study^[15] showed the opposite. These controversial results are probably because of interobserver variation.

CONCLUSION:

1. Left bundle branch block was correlated with coronary heart disease and severe left ventricular dysfunction as studied by ECG, echocardiography and coronary angiography.
2. The more widening of QRS complex in patients with LBBB is correlated with more severity of left systolic ventricular dysfunction.

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