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Original article

Main clinical determinants of the presence of coronary artery disease in patients with left bundle branch block

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Summary. *Background:* Considering clinical parameters as main predictors for coronary artery disease (CAD) in patients with left bundle branch block (LBBB) can be very helpful to explain high likelihood of ischemic events in LBBB conditions. In the present study, we attempted to identify major clinical determinants to predict CAD occurrence in patients with LBBB. *Methods:* A retrospective chart review of 229 consecutive patients with the diagnosis of complete LBBB pattern on electrocardiograms was conducted. The final diagnosis of LBBB was based on the Criteria Committee of the New York Heart Association. The participants were also classified based on coronary angiography evidences into two groups including CAD patients (n = 99) and non-CAD patients (n = 130). *Results:* Among 99 patients with CAD, 27 (27.3%) had single vessel disease, 30 (30.3%) had two-vessel disease and 42 (42.4%) had three-vessel disease. Also, only two of them had left main lesions. The number of diseased coronary vessels was significantly higher in men than in women so that three vessels disease in men was revealed in 28% and in women was observed in 10.9% (p = 0.002). Using a multivariable logistic regression analysis, male gender (2.445, 95% CI: 1.372-4.367, p = 0.002), advanced age (1.063, 95% CI: 1.032-1.095, p < 0.001), and cigarette smoking (4.112, 95% CI: 1.145-8.635, p = 0.012) were main predictors of CAD in LBBB patients. *Conclusion:* A notable number of patients with LBBB suffered concomitantly from CAD that the presence and severity of this ischemic event could be predicted by male gender, advanced age, and history of smoking in these patients. (www.actabiomedica.it)

Key words: coronary artery disease, branch block, heart

Introduction

Left bundle branch block (LBBB) is a relatively common finding in electrocardiography associated with a variety of cardiac abnormalities that can be more commonly pointed to systemic hypertension, coronary artery disease (CAD), and less common to valvular heart disease, myocarditis, and different types of cardiomopathies (1). Even, in some patients with normal structural and functional cardiovascular conditions except for conductive abnormalities, the appearance of LBBB has been shown (2). Some histological studies have identified conduction pathways fibrosis as the main underlying abnormality inducing LBBB (3-5). According to recent cardio-epidemiological studies, the overall prevalence of LBBB in general population widely varies based on the age variable from 0.4% in the middle aged to 5.7% at octogenarians (6). Also, CAD developing has been interestingly more reported in patients with LBBB compared to those without this conductive impairment (7,8). Furthermore, recent investigations have shown higher death rate in LBBB patients (9,10), particularly in those with concomitant CAD (11,12). In this regard, specialists substantially mention accurate and timely diagnosis of coronary arteries involvement in patients with LBBB. In this con-

text, the use of electrocardiography remained a challenge in detailed diagnosis of CAD in LBBB patients (13). Besides, the use of complementary diagnostic techniques such as echocardiography and scintigraphic studies may be difficult because of their cost and unavailability (14,15). Thus, considering traditional clinical characteristics as main predictors for CAD in these patients can be very helpful indicating high likelihood of ischemic events in LBBB conditions. In the present study, we attempted to identify major clinical determinants to predict CAD occurrence in patients with LBBB.

Methods

A retrospective chart review of 229 consecutive patients with the diagnosis of complete LBBB pattern on electrocardiograms was conducted in Sina Heart hospital in Isfahan between 2008 and 2012. The final diagnosis of LBBB was based on the Criteria Committee of the New York Heart Association as "QRS interval ≥ 120 ms, notched, wide and predominant R waves in leads I, a VL, V5, and V6, notched and broad S waves in V1and V2 with absent or small R waves, notching or a plateau in the mid – QRS wave, ventricular activation time > 50 ms at the onset of the QRS interval, M-shaped QRS variants with occasionally wide R waves in V5 and V6, no initial Q wave over the left precordium and absence of preexcitation" (16). In this study, only CAD suspected patients who were evaluated angiographically for proving or ruling out coronary arteries involvement were included into the study. For this purpose, selective coronary angiography was conducted using the Judkins technique in multiple projections and CAD was defined as ≥ 70 % luminal diameter narrowing of a major epicardial artery or ≥ 50% narrowing of the left main coronary artery (17). Therefore, participants were classified into two groups including CAD patients (n = 99) and non-CAD patients (n = 130). Review Board and Ethics committee at Isfahan University of Medical Sciences approved the study. Demographic characteristics and clinical criteria of the patients were extracted from hospital-recorded files and entered into a computerized database form. The patients were given self-administered questionnaires about their medical history and risk profile including CAD risk factors: current smoking history (patients regularly smoke a tobacco product/products one or more times per day or have smoked in the 30 days prior to admission) (18), hypercholesterolemia (total cholesterol ≥5.0 mmol/l, HDL-cholesterol ≥1.0 mmol/l in men, or ≥1.1 mmol/l in women, and triglycerides ≥2.0 mmol/l) (19), family history of CAD (first-degree relatives before the age of 55 in men and 65 years in women) (20), hypertension (systolic blood pressure ≥140 mmHg and/or diastolic ≥90 mmHg and/or on antihypertensive treatment) (21), and diabetes mellitus (symptoms of diabetes plus at least one of the following: plasma glucose concentration ≥11.1 mmol/l, fasting plasma glucose ≥7.0mmol/l, and 2-hpp ≥11.1 mmol/l) (22). The study endpoint was to determine main clinical indicators of the presence of CAD as predictors. Results were reported as mean ± standard deviation (SD) for the quantitative variables and percentages for the categorical variables. The groups were compared using the Student's t-test for the continuous variables and the chi-square test (or Fisher's exact test if required) for the categorical variables. Predictors exhibiting a statistically significant relation with CAD in the Univariate analyses (with considering p-value < 0.1) were taken for multivariate logistic regression analysis to investigate their independence as predictors. Odds ratio (OR) and 95% confidence intervals (CI) were calculated. P-values of 0.05 or less were considered statistically significant. All the statistical analyses were performed using SPSS version 13.0 (SPSS Inc., Chicago, IL, USA) and SAS version 9.1 for Windows (SAS Institute Inc., Cary, NC, USA).

Results

All studied participants suffered from LBBB that among them, 99 patients had concomitantly CAD and 130 were categorized as non-CAD group. As shown in table 1, patients with CAD were older and smoked the cigarette heavier currently. However, the two groups were similar in terms of other traditional CAD risk factors including family history of CAD, hyperlipidemia, hypertension, diabetes mellitus, and hypertension. The mean left ventricular ejection fraction in

Table 1. Baseline characteristics and clinical data of study population

Characteristics	(LBBB+/CAD+) group (n = 99)	(LBBB+/CAD-) group (n = 130)	P-value
Male gender	53 (53.5)	47 (36.2)	0.009
Age, yr	69.42 ± 9.57	63.88 ± 10.04	< 0.001
Family history of CAD	17 (17.2)	20 (15.4)	0.718
Hyperlipidemia	41 (41.4)	59 (45.4)	0.465
Current smoking	18 (18.2)	12 (9.2)	0.046
Hypertension	42 (42.4)	67 (51.5)	0.351
Diabetes mellitus	29 (29.3)	28 (21.5)	0.465
Heart failure	15 (15.2)	17 (13.1)	0.868
NYHA score			0.512
II	25.3 (25.3)	47 (36.2)	
III	21 (21.2)	27 (20.8)	
IV	3 (3.0)	2 (1.5)	
LV ejection fraction, %	39.42 ±13.16	43.22 ± 12.99	0.165

CAD group was 39.42 ±13.16% and 43.22 ± 12.99% with no significant difference. Overall, Among 99 patients with CAD, 27 (27.3%) had single vessel disease, 30 (30.3%) had two-vessel disease and 42 (42.4%) had three-vessel disease. Also, only two of them had left main lesions. As presented in figure 1, the number of diseased coronary vessels was significantly higher in men than in women so that three vessels disease in men was revealed in 28% and in women was observed in 10.9% (P = 0.002). Using a multivariable logistic regression analysis, male gender (2.445, 95% CI: 1.372-4.367, p = 0.002), advanced age (1.063, 95% CI: 1.032-1.095, p < 0.001), and cigarette smoking (4.112, 95% CI: 1.145-8.635, p = 0.012) were main predictors of CAD in LBBB patients.

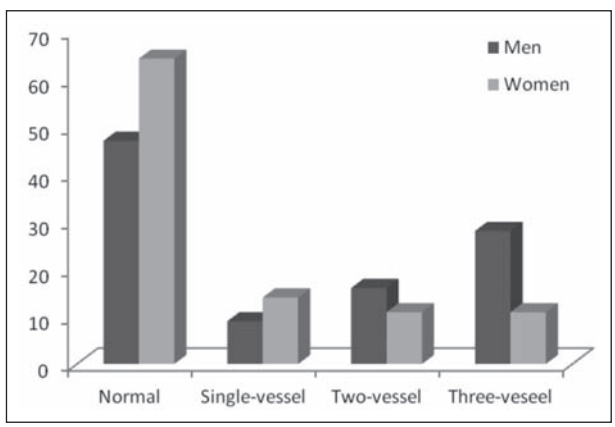

Figure 1. Number of involved coronary vessels in men and women with LBBB

Table 2. Main predictors of CAD in LBBB patients using a multivariable logistic model

Characteristics	P-value	Odds Ratio	95% CI
Male gender	0.002	2.445	1.372-4.367
Age	< 0.001	1.063	1.032-1.095
Family history	0.538	0.779	0.352-1.724
Current smoking	0.012	4.112	1.145-8.625
NYHA score	0.416	0.875	0.635-1.207
Hyperlipidemia	0.307	1.811	0.714-4.354
Hypertension	0.489	1.324	0.601-2.547
Diabetes mellitus	0.148	0.620	0.324-1.184

Discussion

The present attempted to first determine overall prevalence of CAD in patients with LBBB and also identify main predictors of CAD appearance in this subgroup of heart disease patients. In this regard, the presence and extension of coronary involvement was assessed in 229 LBBB patients referred for coronary angiography. According to our observation, 43.2% of patients suffered concurrently from CAD that more than one-third of them had multi-vessels involvement. However, only 1.5% had left main lesions. The previous reports on left main or multi-vessel disease were pointed different evidences. In a similar study by Ghaffari and colleagues (23) on similar population, 16.9 % of patients had left main or three-vessel CAD that was 13% in the study of Nguyen et al (24) and about 17 % in the report of Abrol et al (25). In total, published

studies have demonstrated a CAD prevalence of about 50% in patients with

LBBB undergoing coronary angiography that was consistent with our results (23-25).The differences in occurrence of CAD in LBBB patients might be in order to some potential selection and diagnostic biases such as defining different cutoff points of coronary narrowing to discriminate angiographic CAD from non-CAD states, as well as technical differences regarding applied methods for diagnosis of CAD in LBBB patients. With respect to the first bias, a recent meta-analysis of non-invasive CAD assessment in LBBB patients revealed that exercise ECG and myocardial perfusion imaging had the highest sensitivity, while stress echocardiography had the highest specificity (26). In this line, it seems that the use of coronary angiography in suspected LBBB patients might have the optimal accuracy for assessment of coronary involvement. In our study, the preserved left ventricular ejection fraction could be also explained by rarely left main involvement, while in those studies with high rate of left main lesions in LBBB patients, concurrent reduced left ventricular ejection fraction was also detected (27,28).

In our study, the main predictors of CAD in patients who suffered LBBB included male gender, advanced age, and smoking. In Ghaffari et al. study (23), advanced age, male gender, history of chest pain and LVEF<50% were predictors of CAD. In Jeevanantham et al. study (28), patients with LBBB were older and higher percentages were women compared to non-LBBB patients. In addition, the conventional risk factors such as diabetes mellitus and hypertension were more prevalent in LBBB patients. Furthermore, in some studies (29), total cholesterol levels and smoking were found to be significant predictors of CAD in the present study that was in contrast with some other publications emphasizing lower left ventricular function assessed by ventricular ejection fraction as main determinant of CAD in LBBB patients (24,25). In total, it seems that traditional risk factors for CAD are in consistent with the min indicators of CAD in patients with LBBB, however the value of these risk factors maybe different according to the prevalence of these factors in various populations, also to their considering as predictive variables in multivariable regression models.

Some evidences have emphasized the fundamental differences on coronary arteries anatomy in LBBB as main responsible for higher incidence of CAD (26-28). However, the present evidences remained conflicting. It has been shown by some authors a different left main coronary artery anatomy and branches causing difference coronary flow in LBBB patients (29,30), however, there was no significant difference in the lengths and shape of left main coronary artery in patients with and without LBBB in some other studies (31). We believe that the anatomical pattern of coronary arteries may not have a key role to explain higher rate of CAD in LBBB, while CAD common risk factors have the major role.

As a main point in our survey was introducing smoking as a main determinant for CAD in patients with LBBB. Similarly, Myali et al (32) also showed that smoking beside of male gender, diabetes, echocardiographic finding of LV dysfunction or regional wall motion abnormalities were a risk factors for CAD in LBBB patients. It was also shown in another study by Tabrizi et al (33) that the smoking is a main indicator for CAD in these patients. However in some other studies such as Hashemi Jazi et al (34) survey, average age, history of diabetes mellitus, hyperlipidemia, and smoking could not predict CAD in LBBB background. Dissociation between CAD and smoking in LBBB patients was also shown in the study by Jeong et al (35). in total, although smoking is an overall potential risk profile for CAD and its severity, it seems that the role of smoking in LBBB patients has remained uncertain and based on some evidences, history of smoking may not have a potential role in presence and extension of ischemic events in LBBB patients.

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