Clinical and angiographic importance of right bundle branch block in the setting of acute anterior myocardial infarction

Akut anterior miyokard enfarktüsünde sağ dal bloğunun klinik ve anjiyografik önemi

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ABSTRACT

Objective: To investigate functional status of patients (Killip class), left ventricular contractility, angiographic anatomy and severity of coronary lesions in patients with and without right bundle branch block (RBBB) in the setting of anterior myocardial infarction (MI).

Methods: Patients who admitted to coronary care unit with the diagnosis of acute anterior MI between 1999 and 2005 were retrospectively searched from our database. Out of 792 patients, 37 had RBBB (RBBB group) either at admission or in the course of anterior MI. Forty patients who developed no intraventricular conduction defect during the course of anterior MI with the same demographic characteristics were selected as the control group.

Results: Out of 37 patients, 30 had RBBB on admission and 7 developed RBBB in the course of acute MI. Left anterior descending artery (LAD) proximal lesion was more commonly detected in the RBBB group [23 (62.2%) vs. 11 (27.5%) patients, p=0.003]. Left ventricular ejection fraction was lower (33.0±4.2% vs 36.7±4.9%, p=0.003) and end-systolic volume was higher (84.1±24.9 ml vs 74.6±22.0 ml, p=0.012) in patients with RBBB. Number of patients with high Killip grade (III and IV) was more in the RBBB group [7 (18.9%) vs 3 (7.5%), RR: 1.75, %95 CI 0.92-3.32, p=0.14], and number of patients with Killip grade I was more in the control group [34 (85.0%) vs 22 (59.5%), p=0.012]. Besides mean Killip class was higher in the RBBB group (1.65±0.90 vs 1.25±0.67, p=0.03). Three patients (8.1%) in the RBBB group and 2 patients (5.0%) in the control group died during hospitalization (p=0.67).

Conclusion: Left ventricular ejection fraction decreases and Killip grade increases in case of RBBB in the setting of acute anterior MI. Culprit lesion in patients with RBBB is more commonly a LAD proximal lesion and threatened myocardial tissue is larger in patients with RBBB. *(Anadolu Kardiyol Derg 2008; 8: 123-7)*

Key words: Acute anterior myocardial infarction, coronary angiography, right bundle branch block

ÖZET

Amaç: Akut anterior miyokard infarktüsü (MI) ile sağ dal bloğu (RBBB) birlikteliğinde hastaların fonksiyonel durumunu (Killip sınıflaması), sol ventrikül kontraktilitesini, anjiyografik anatomiyi ve koroner lezyon ciddiyetini değerlendirmek.

Yöntemler: Akut anterior MI tanısı ile 1999-2005 yılları arasında koroner yoğun bakım ünitesine yatırılan 792 hasta retrospektif olarak tarandı. Bu hastaların 37'sinde başvuru elektrokardiyogramlarında (EKG) ya da takiplerinde RBBB izlenmişti (RBBB grubu). Akut anterior MI seyrinde intraventriküler ileti defekti bulunmayan benzer demografik özelliklere sahip 40 hasta ise kontrol grubu olarak çalışmaya alındı. Bu hastaların koroner anjiyografi ile ekokardiyografi bulguları, Killip sınıflaması ve hastane içi mortaliteleri araştırıldı.

Bulgular: Otuz yedi hastanın 30'unun başvuru EKG'sinde RBBB mevcuttu. Geri kalan 7'sinde ise takipte RBBB gelişmişti. Sağ dal bloğu grubunda infarktüsten sorumlu lezyon sol ön inen (LAD) arterde daha proksimalde bir lezyondu (23 [%62.2]'e karşın 11 [%27.5], P=0.003). Sol ventrikül ejeksiyon fraksiyonu RBBB grubunda daha düşükken (%33.0±4.2'e karşın %36.7±4.9, p=0.003) sol ventrikül sistol sonu çapı daha yüksekti (84.1±24.9 ml karşın 74.6±22.0 ml, p=0.012). İstatistiksel olarak anlamlı olmasa da yüksek Killip sınıfı olan hastalar (Killip sınıf III ve IV) RBBB grubunda daha fazla sayıdaydı (7'ye karşın 3, RR: 1.75, %95 CI 0.92-3.32, p=0.14) aksine Killip sınıfı I olan hasta sayısı kontrol grubunda anlamlı oranda daha fazlaydı (22'ye karşın 34, RR: 0.80, %95 CI 0.62-1.03, P = 0.029). Ayrıca RBBB grubunda ortalama Killip sınıfı daha yüksekti (1.65±0.90'a karşın 1.25±0.67, P=0.03). Sağ dal bloğu grubundaki 3 (%8.1) hasta ve kontrol grubundaki 2 (%5.0) hasta hastanedeki takibi esnasında eksitus oldu (p=0.67).

Sonuç: Akut anterior MI ve RBBB birlikteliğinde ejeksiyon fraksiyonu düşmektedir ve Killip sınıfı artmaktadır. Bu hastalarda infarktüs ile ilişkili lezyon sıklıkla LAD proksimal lezyonudur, dolayısıyla daha geniş bir miyokard alanı tehdit altındadır. *(Anadolu Kardiyol Derg 2008; 8: 123-7)*

Anahtar kelimeler: Akut anterior miyokard infarktüsü, koroner anjiyografi, sağ dal blok

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Introduction

The prevalence of bundle branch block in the setting of acute myocardial infarction (MI) is 1.6 - 10.9% in different series (1-3) and no significant difference is found between left bundle branch block or right bundle branch block (RBBB). Development of a new bundle branch block either left or right in the setting of acute MI indicates presence of an extensive MI (4) and poor prognosis (5). In a recent study (6), even in the coronary intervention era, RBBB has been found to be still associated with an increased 30-day mortality rate.

However, the importance of RBBB in acute anterior MI is still underrecognized and RBBB is not present in current risk stratification algorithms ("Thrombolysis In Myocardial Infarction" and "Global Utilization of Streptokinase and t-PA for Occluded Coronary Arteries") (7, 8) and is not accepted as a major risk factor in the current guidelines (9, 10). However occurrence of RBBB may be seen with more proximal left anterior descending artery (LAD) involvement, as a result its prognosis may be worse due to a larger myocardial area which is jeopardized and early revascularization with primary percutaneous coronary intervention (PCI) can be more beneficial in patients with RBBB.

We designed this study to investigate the functional status of patients (Killip class), left ventricular contractility, angiographic anatomy and severity of coronary lesions in patients with and without RBBB in the setting of anterior MI.

Methods

Patients population

Patients admitted to our coronary care unit with the diagnosis of acute anterior MI between 1999 and 2005 were retrospectively searched from our database. Out of 792 patients, 37 had RBBB either at admission or in the course of acute MI and underwent coronary angiography (RBBB group). Forty patients who developed no intraventricular conduction defect during the course of acute MI with the same demographic characteristics were selected as the control group.

Electrocardiography

The electrocardiograms of the patients were reviewed by experienced cardiologists. Acute anterior MI was diagnosed if there was ≥2 mm of ST elevation in two contiguous leads between V1 and V3. Isolated ST elevation of ≥1 mm in two contiguous lateral leads between V4 and V6, I, and AVL was also classified as acute anterior MI (9, 11). The RBBB was defined as a prolonged QRS duration of ≥0.12 seconds or an rsr', rsR', or rSR' patterns in lead V1 or V2. Leads V6 and I had to show a QRS complex with a wide S-wave (S duration ≥R duration or ≥0.04 s (12). An intraventricular conduction defect was defined as any situation in which QRS duration is ≥ 0.12 seconds.

Echocardiography

All patients underwent complete transthoracic echocardiographic studies in 72 hours after MI, which include two dimensional, color flow and pulsed Doppler imaging with a GE-Vingmed Vivid 3 system (GE-Vingmed Ultrasound AS, Horten, Norway). Standard transthoracic echocardiographic views were used to obtain left ventricular (LV) ejection fraction (EF), LV end-diastolic diameter, LV end-diastolic and end-systolic volumes. Left ventricular EF (%) was calculated according to the following formula: "100 x [(left ventricular end-diastolic volume - left ventricular end-systolic volume) / left ventricular end-diastolic volume]" (13).

Coronary Angiography

Standard selective coronary angiography with at least 4 views of the left coronary system and 2 views of the right coronary artery was performed using the Judkins technique. In 2 (4.9%) patients in the RBBB group and 2 (5.0%) patients in the control group who underwent primary PCI for acute MI, only left coronary system views were available. Culprit lesion was defined as proximal left anterior descending artery (LAD) lesion if it was between LAD ostium and first septal or diagonal artery, distal LAD lesion if it was distal to the first septal or diagonal artery. Significant coronary artery disease (CAD) was defined as lesions ≥70% by visual examination of any main epicardial coronary artery and ≥50% in the left trunk. For the analysis of multivessel disease in acute anterior MI, the number of diseased vessels was identified according to the number of the major coronary arteries having ≥70% stenosis.

Coronary angiography and echocardiographic findings, Killip classification and in-hospital mortality of the patients with RBBB and the control group were investigated.

Statistical analysis

The statistical analysis of the results was performed using the Statistical Package for Social Sciences (SPSS, Chicago, Illinois, USA), version 11.5 software for Windows. Data were tested for normal distribution using the Kolmogorov-Smirnov test. The nominal variables were shown as number of cases with percentage and continuous variables were shown as mean±standard deviation. The Chi-square test or Fisher's exact test was used for the categorical comparisons. Whether the mean differences between RBBB group and control group were significant or not were evaluated using Student's t test or non-parametric Mann-Whitney U test. P value of <0.05 was considered as significant.

Results

The demographic characteristics of the patients were similar (Table 1). Out of 37 patients in the RBBB group, 30 had RBBB at admission and the rest 7 developed RBBB in the course of acute MI. None of the recently developed RBBB and 4 of the 30 RBBB at admission, a total number of 4 (10.8%) from 37 RBBB resolved before hospital discharge. Out of these patients, 16 (43.2%) of them underwent primary PCI, and thrombolytic treatment was administered to 21 (56.8%) patients. In control group, 15 (37.5%) underwent primary PCI and thrombolytic treatment was administered to 25 (62.5%) patients. No significant difference was found between two groups when the treatment strategies for acute MI were considered (p=0.5).

All patients in both groups underwent coronary angiography before hospital discharge. The clinical, echocardiographic and angiographic characteristics of the patients are highlighted in Table 2. The LAD proximal lesion was detected more commonly in patients with RBBB. Besides LVEF was lower (p=0.003) and LV end-systolic volume was higher (p=0.01) in patients with RBBB (Table 2). Number of patients with high Killip grade (III and IV) was

more in the RBBB group [7(18.9%) vs 3 (7.5%), RR: 1.75, %95 CI 0.92-3.32, P=0.14], and number of patients with Killip grade I was more in the control group [34 (85.0%) vs 22(59.5%), p=0.012]. Besides mean Killip score was higher (p=0.03) in the RBBB group as compared with control one (Table 2). Three patients (8.1%) in the RBBB and 2 patients (5.0%) in the control group died during hospitalization (p=0.667).

Discussion

In this study, we showed that RBBB in the course of acute anterior MI has worse clinical and angiographic characteristics when compared to patients with no intraventricular defect. This is an important finding because early revascularization of patients with RBBB may be more important to salvage more myocardial tissue.

Wong et al (11) demonstrated that RBBB in the setting of acute anterior MI was an independent 30-day mortality predictor. In this study, the baseline clinical characteristics were worse in RBBB group but after adjustment for these factors, 30-day mortality was still higher in patients with anterior MI and RBBB. In our study, the clinical characteristics of two groups were similar and we could not show a mortality difference but our study population was small and only in-hospital short-term mortality was investigated. Because the patients with RBBB had more proximal LAD involvement, the jeopardized myocardial area was larger and as a result they might have higher long-term mortality and morbidity rates.

In a recently published article (14), RBBB was found to be only related to increased risk of sudden cardiac death/resuscitated cardiac arrest but left bundle branch block was associated with increased risk for all-cause death, cardiovascular death, and sudden cardiac death/resuscitated cardiac arrest. But in this study, patients with non-anterior MI had been also included. The prognosis of co-existence of RBBB with inferior MI was not different from the ones with normal conduction in another study (11). This may explain those findings in the study by Bogale et al (14).

In the article by Di Chiara (15), it was stated that RBBB should be 'blindly' considered as a consequence of acute anterior MI. In our study, LAD proximal lesions were found to be more common in patients with RBBB. This finding is consistent with this theory because proximal LAD occlusion before septal artery may lead to RBBB due to septal ischemia.

Killip class was higher and heart failure was more common in patients with RBBB as a result of more proximal LAD occlusion and more jeopardized myocardial tissue. Besides in patients with RBBB, LV EF was lower and LV end-systolic diameter was higher. There was no difference between two groups with respect to LV end-diastolic diameter. This may be explained by the early timing of echocardiography because there has been no time for LV remodeling in these patients. These are important findings because prompt treatment with early percutaneous revascularization may decrease this potentially fatal complication, heart failure due to ischemic cardiomyopathy, and improve their prognosis.

However, even coronary intervention was performed at approximately a mean of 4 hours after chest pain, RBBB was found to be still associated with a higher mortality in patients with acute anterior MI (6). Nevertheless, earlier recognition and emergent percutaneous intervention of these patients may be beneficial to salvage more myocardial tissue.

The resolution of bundle branch block has been reported in several studies (16-18) after PCI or thrombolytic treatment. A resolution rate of 12% was reported by Sgarbossa et al (1). Our results were also comparable with this study (10.8% resolution of RBBB).

Limitations of the study

Our study has several limitations. It is a retrospective study which does not have enough power to show increased mortality in patients with RBBB as shown before (5). Despite careful selection of the control group to match with the RBBB group with regard to the baseline demographic characteristics (primary PCI or thrombolytic treatment), there may be a selection bias in the control group.

Table 1. Demographic characteristics of the patients

Variable	RBBB group (n=37)	Control group (n=40)	p
Age, years	57.6±11.5	57.8±11.3	NS
Male sex, n (%)	32 (86.5)	35 (87.5)	NS
Risk factors, n (%)			
Diabetes Mellitus	5 (13.5)	6 (15.0)	NS
Hypertension	14 (37.8)	16 (40.0)	NS
Hyperlipidemia	9 (18.9)	8 (20.0)	NS
Family history for CAD	11 (29.7)	11 (27.5)	NS
Cigarette smoking, n (%)			
Current smoker	13 (35.1)	14 (35.0)	
Past smoking	9 (24.3)	11 (27.5)	NS
Never used	15 (40.5)	15 (37.5)	

Data are represented as Mean±SD and percentages/proportions
Student's t and Chi-square tests were used.
CAD - coronary artery disease, NS - not significant, RBBB - right bundle branch block
Diabetes mellitus was defined in patients who were already using anti-diabetic medication.
Hypertension was defined as blood pressure >140/90 mmHg after the initial stressful event with chest pain resolved or current usage of antihypertensive drugs.
Hyperlipidemia was defined in patients whose fasting plasma low density lipoprotein levels>130 mg/dl or triglyceride levels >200 mg/dl.
Family history was defined as early occurrence of CAD in first degree family members.

Table 2. Clinical, echocardiographic and angiographic characteristics of the patients

Variable	RBBB group (n=37)	Control group (n=40)	p
Localization of culprit lesion, (%)			
Proximal LAD artery	23 (62.2)	11 (27.5)	0.003
Distal LAD artery	14 (37.8)	29 (72.5)	
Killip classification, n (%)			
Class I	22 (59.5)	34 (85.0)	
Class II	8 (21.6)	3 (7.5)	0.108
Class III	4 (10.8)	2 (5.0)	
Class IV	3 (8.1)	1 (2.5)	
Mean Killip score	1.65±0.90	1.25±0.67	0.03
Death, n (%)	3 (8.1)	2 (5.0)	NS
Other vessel involvement, n(%)			
Left main coronary artery	1 (2.7)	1 (2.5)	NS
Circumflex artery	13 (35.1)	14 (35.0)	NS
Right coronary artery	11 (29.7)	10 (25)	NS
Classification according to vessel involvement, n(%)			
1-vessel disease	16 (43.3)	18 (45.0)	
2-vessel disease	18 (48.6)	20 (50.0)	NS
3-vessel disease	3 (8.1)	2 (5.0)	
Echocardiographic findings			
LV end-diastolic diameter, mm*	50.1±6.1	49.5±6.4	NS
	(49, 37-60)	(50, 37-62)	
LV end-diastolic volume, ml	121.1±30.0	120.2±29.8	NS
LV end-systolic volume, ml	84.1±24.9	74.6±22.0	0.012
LV ejection fraction, %	33.0±4.2	36.7±4.9	0.003

Data are represented as Mean±SD, percentages/proportions and *median, minimum-maximum values; Mann-Whitney U test, unpaired Student's t test, Chi-square and Fisher's exact tests
LAD- left anterior descending artery, LV- left ventricle, NS - not significant, RBBB- right bundle branch block

Conclusion

The culprit lesion in patients with RBBB and acute anterior MI is more commonly a LAD proximal lesion and jeopardized myocardial tissue is larger in patients with RBBB. As a result, these patients should receive more aggressive treatment with early revascularization to decrease morbidity and mortality.

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