

A Descriptive Study: - 2D - Echocardiography and Coronary Angiography Changes of RBBB in Acute Myocardial Infarction

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Abstract: Introduction: The new European Society of Cardiology guideline for ST- segment elevation myocardial infarction recommends that left and right bundle branch block should be considered equal for recommending urgent angiography in patients with suspected myocardial infarction. Aim: To investigate 2D Echocardiography and angiographic changes in 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 Cardiac Care Unit with the diagnosis of acute anterior MI between Jan 2018 and Feb 2021 were retrospectively searched from our database. Out of 826 patients, 27 had RBBB (RBBB group) either at admission or in the course of anterior MI. 35 thirty five patients who developed no intraventricular conduction defect during the course of anterior MI with selected as the control group. Results: Out of 27 patients, 20 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 [16 (59.2%) vs. 5 (25%) patients, $p=0.003$]. Left ventricular ejection fraction was lower ($33.0\pm 4.2\%$ vs $36.7\pm 4.9\%$, $p=0.003$) 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 NYHA Killip grade (III and IV) was more in the RBBB group and number of patients with Killip grade I was more in the control group. Besides mean Killip class was higher in the RBBB group (1.65 ± 0.90 vs 1.25 ± 0.67 , $p=0.03$). Two patients (7.4%) in the RBBB group and one 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.

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

1. Introduction

Acute coronary syndrome, being a leading cause of morbidity and mortality, has become a major public health problem. In MI, occlusion of coronary arteries at different levels affects the conduction system of heart leading to various type of blocks. Previous studies pertaining to patients with AMI and BBB, left and right (LBBB & RBBB) at hospital admission were both in prethrombolytic and thrombolytic era and reported a overall poor prognosis and high risk for short term death.^{2, 9, 12}

Complete BBB, left or right, on electrocardiogram at presentation occurs in a wide range of 8% to 23% of patients with AMI and represents an independent important predictor of in hospital complications and poor survival.^{1 - 13} New BBB usually expresses a large infarction, frequently accompanied by heart failure, complete AV block, arrhythmia and high mortality rates.¹⁰ In the present study, an attempt has been made to assess clinical characteristics and short term prognostic significance of BBB in acute MI, with respect to its location, time of appearance and association with complications.

2. Material and Method

The study was done on patients of acute MI admitted between Jan 2018 to Feb 2021 in the Cardiac care unit of Rajarajeswari medical college & hospital with following inclusion and exclusion criteria. Informed and written consent was taken from all patients before enrolling this work.

Out of 826 patients, 27 had RBBB (RBBB group) either at admission or in the course of anterior MI. 35 thirty five

patients who developed no intraventricular conduction defect during the course of anterior MI with 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 $\geq R$ 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 Philips. 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 $\geq 70\%$ by visual examination of any main epicardial coronary artery and $\geq 50\%$ 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 $\geq 70\%$ 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 \pm 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.

3. Results

The demographic characteristics of the patients were similar (Table 1)

Table 1: Echocardiographic and angiographic characteristics of the patients

Variable	RBBB, N=27	Control, N=40	P Value
Localization of culprit lesion, (%)			
Proximal LAD artery	N=16 (59.25%)	N=11 (27.5%)	0.003
Distal LAD artery	N=11 (40.75%)	N=29 (72.5%)	
Killip classification, n (%)			
Class I	16 (59.25%)	34 (85.0)	0.108
Class II	5 (18.51%)	3 (7.5)	
Class III	2 (7.40%)	2 (5.0)	
Class IV	4 (14.84%)	1 (2.5)	
Mean Killip score	1.65 \pm 0.90	1.25 \pm 0.67	0.03
Death, n (%)	2 (7.4%)	1 (5%)	NS
Classification according to vessel involvement, n (%)			
1 - vessel disease	11 (40.7%)	18 (45.0)	NS
2 - vessel disease	13 (48.14%)	20 (50.0)	
3 - vessel disease	3 (11.11%)	2 (5.0)	
Echocardiographic findings			
LVend - diastolic diameter, mm*	50.1 \pm 6.1 ((49, 37 - 60)	49.5 \pm 6.4 ((50, 37 - 62)	NS
LVend - diastolic volume,	121.1 \pm 30.0	120.2 \pm 29.8	NS
LV end - systolic volume, ml	84.1 \pm 24.9	74.6 \pm 22.0	0.012
LV ejection fraction, %	33.0 \pm 4.2	36.7 \pm 4.9	0.003

Data are represented as Mean \pm 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

Out of 27 patients in the RBBB group, 20 had RBBB at admission and the rest 7 developed RBBB in the course of acute MI. None of the recently developed RBBB and 3 of the 20 RBBB at admission, a total number of 3 (11.1%) from 27 RBBB resolved before hospital discharge. Out of these patients, 11 (40.7%) of them underwent primary PCI, and thrombolytic treatment was administered to 15 (55.5%) 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. 2D - 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). Two patients (7.4%) in the RBBB group and one patients (5.0%) in the control group died during hospitalization ($p=0.67$).

4. Discussion

In this study, revealed that RBBB in the course of acute anterior MI has worse echocardiographic 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. 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. As compared to Wong et al (11) demonstrated that RBBB in the setting of acute anterior MI was an independent 30 - day mortality predictor.

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 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. As compared to Di Chiara (15), it was stated that RBBB should be 'blindly' considered as a consequence of acute anterior MI. 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).

5. 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.

6. 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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