In-Hospital Outcomes of Patients Presenting with Acute Anterior STEMI with Right Bundle Branch Block

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ABSTRACT

Objective: To assess the in-hospital outcomes in Anterior wall ST Elevation Myocardial Infarction patients presenting with Right Bundle Branch Block with different reperfusion strategies.

Study Design: Analytical Cross-Sectional Study.

Place and Duration of Study: Department of Cardiology, Rawalpindi Institute of Cardiology, Rawalpindi Pakistan, from Sep 2020 to Feb 2021.

Methodology: Patients with myocardial infarction who presented to the emergency department of the hospital were included in the study. Further evaluation was performed on individuals with ST elevation in anterior chest leads and new-onset or presumably new Right bundle branch block on electrocardiogram. Anterior wall myocardial infarction was diagnosed based on 4th universal definition of Myocardial infarction. Patients excluded were those with non-anterior ST-elevation myocardial infarction, prior coronary artery bypass grafting, previous percutaneous coronary intervention, or Left bundle branch block. The treatment plan was chosen by the interventional cardiologist. Various parameters were used to measure the outcomes of different therapies.

Results: 93 patients were included with 72(77.4%) males and 21 females (22.5%). Mean age was 59.91±11.93 years. Premorbid seen was 41.9% diabetes, 32.3% hypertension, 18.3% smoking. Transient RBBB was seen in 64.5% of the study population and persistence RBBB was 35.5%. Mortality was associated with higher Killip class (p=<0.001), AV block (p=0.078), increased no of coronary vessels involved (p=0.014), increased amplitude of ST elevation (p=0.083) and with lower EF values (p=0.032). Worst outcomes were common in patients on medical treatment.

Conclusion: Poor outcomes in Anterior Wall Myocardial Infarction with Right Bundle Branch Block are linked to length of stay, co morbidities, Killip class, amplitude of ST elevation, coronary artery disease complexity and those managed on medical treatment.

Keywords: Anterior wall MI, Outcomes, RBBB.

INTRODUCTION

Acute Coronary syndrome, particularly St Elevation Myocardial Infarction (STEMI), is considered one of the most common causes of death throughout the world.[1] Conduction defects in the form of Left Bundle Branch Block or Right Bundle Branch Block have been reported in the literature and the frequency varies from 8 to 23% in different studies.[2] Despite the fact that previous guidelines suggest that new-onset LBBB should be treated as if it were an acute myocardial infarction in patients who present with typical signs and symptoms, current guidelines recommend that such patients undergo either thrombolysis or primary angioplasty as part of their treatment. New recommendations, on the other hand, have expanded the application of such an approach to new-onset RBBB.[3]

RBBB is less commonly seen in STEMI patients with a reported incidence of 6-10%.[4] Anatomically, the right bundle is located on the right side of the interventricular septum and has a subendocardial placement in the upper and lower courses, with a deeper course in the middle region of the septum. It receives blood supply from the septal branches of the left anterior descending artery (LAD) and the AV nodal artery, and as a result, it is more usually encountered in anterior or inferior wall STEMI.[5]

In general, RBBB is regarded to be related with poor outcomes in Anterior STEMI because it occurs largely as a result of obstruction of the proximal LAD, resulting in a larger infarct and, thus, more complications of MI. RBBB was related with greater mortality rates prior to the development of thrombolytics.[6] In recent years, however, with the introduction of reperfusion methods like thrombolysis and percutaneous

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intervention, investigations have revealed a range of inconsistent results. According to certain studies, the death rate in Anterior Wall Myocar-dial Infarction patients who present with LBBB is higher when compared to those who present with RBBB,[7] while other studies have found the opposite to be true.[8] Juárez et al. showed that RBBB was conside-red to be an independent predictor of in-hospital death rates.[9] In contrast, with successful reperfusion, the short-term mortality rates were lower in patients with transient RBBB, but this data is limited to date.[10]

We, therefore, aimed to assess the in-hospital outcomes in Anterior wall STEMI patients associated with RBBB with different reperfusion strategies.

METHODOLOGY

Anterior STEMI was diagnosed based on the criteria in the fourth universal definition of MI.[11] ST-elevation was described on the ECG as the elevation at the J point in at least two contiguous leads of ≥2mm (0.2 mV) in men or ≥1.5mm (0.15 mV) in women from leads V1-V6.[12] RBBB was defined with QRS duration greater than 120msec in the chest leads V1 or V2 and having any of the following patterns rsr', rsR, or rSR. In addition, S wave of duration more than R wave or atleast greater than 40 ms should be present in leads I and V6, and finally, R wave peak time in leads V5 and V6 should be normal but greater than 50ms in lead V1.[13]

This analytical cross sectional study was conducted at Rawalpindi Institute of Cardiology, Rawalpindi Pakistan, from September 2020 to February 2021. After approval from the institutional review board, (RIC/RERC/19/20).

Sample Size: The sample size was calculated using World Health Organization (WHO) sample size formula (n=z^2x(p)(1-p)/ α^2), taking prevalence of RBBB in the context of ACS as 6%. Non-probability consecutive sampling was used for data collection.

Inclusion Criteria: All the patients who presented directly or were referred to the hospital's emergency department with symptoms and signs suggestive of Myocardial infarction were included. Those patients who had ST elevation in anterior chest leads and had new-onset or presumably new Right Bundle Branch Block on ECG as assessed by the interventional cardiologist were further evaluated.

Exclusion Criteria: Patients with non-anterior ST Elevation myocardial elevation, previous coronary artery bypass grafting, previous percutaneous intervention, and having Left Bundle Branch Block were excluded from the study.

The treating cardiologist on call decided on cardiac catheterization and reperfusion strategy. Significant coronary artery stenosis was defined when there was ≥50% stenosis compared to normal segment diameter single, double, or triple vessel disease was labeled when one, two, or three vessels showed significant narrowing, respectively.

During the hospital stay, data was collected, including demographic profile, duration of symptoms, comorbid, blood pressure and heart rate on presentation, and Killip class.[12] lead ECG was done at the time of admission and then daily till the day of discharge or death of the patient. In ECG QRS duration, amplitude of ST elevation was evaluated. Consultant cardiologist having experience in performing 2D Echocardiography calculated the Ejection Fraction by using Simpson method. We analyzed frequency of types of RBBB whether transient or persistent, outcomes of death and AV Blocks in our study. Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Categorical variables were summarized as mean±SD and conti-nuous variables were summarized as frequency and percentages. Chi-square test was applied to find out the association. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 93 patients were included in the study, with 72(77.4%) males and 21(22.5%) females. The mean age of the study population was 59.91±11.93 years. Among 93 subjects, 39(41.9%) were diabetics, 30(32.3%) were hypertensive, 7(18.3%) were smokers, and 7.5% had no comorbidities. The mean duration of the hospital stay was. RBBB was transient in 64.5% of the patients. Mean ST elevation was 4.48±2.12 mV, Mean QRS width was 208.38±98.48 seconds, while Mean EF was 25.54±4.8% in the study group. Age was further stratified with the majority of patients 51(54.8%) belonging to age group 41-60 years followed by 37 (39.8%) having age >61 years, and 5(5.4%) were in the age group 20-40 years. The majority of the patients, 69 (74.2%), stayed in the hospital for 2 days while only 1(1.1%) patient had a stay of 10 days. 80(86%) patients presented to the hospital with the duration of symptoms <12 hours, while 6(6.5%) had a duration > 24 hours Table-I.

Table-II shows different reperfusion strategies and a comparison of the frequency of different parameters, including types of RBBB, Killip Class,

Angiographic findings, and mortality rates. Overall, PCI was employed in 34(37.8%) patients compared to thrombolysis in 26(28.0%).

Table-I: Baseline and Clinical characteristics of the patients

Parameters	Mean±SD/ n(%) (n=93)	Percentage (%)
Males	72	77.4%
Age Groups		
20-40 years	5	5.4%
41-60years	51	54.8%
>60 years	37	39.8%
Diabetes Mellitus	39	41.9%
Hypertension	30	32.3%
Smoking	17	18.3%
QRS Duration (Mean±SD)	208.38±98.48	-
ST Elevation Magnitude (mV)	4.28±2.06	-
Duration of Hospital Stay (days)	2.38±1.39	-
Ejection Fraction	25.54±4.8	-
Duration of Symptoms		
<12 hours	80	86.0%
12-24 hours	7	7.5%
>24 hours	6	6.5%
Right Bundle Branch Block		
Transient	60(64.5%)	
Persistent	33(35.5%)	
KILLIP Class ≥2	51	54.8%
Atrioventricular Blocks	16	17.2 %

Table-II: Association of Treatment with Hospital stay, AV Blocks, Death

Parameters	Treatment			p-value
	Medical n(%)	SK n(%)	PCI n(%)	
Duration of Stay				
1 day	5(5.4)	2(2.2)	1(1.1)	
2 days	22(23.7)	19(20.4)	28(30.1)	
3 days	2(2.2)	2(2.2)	2(2.2)	
4 days	1(1.1)	1(1.1)	2(2.2)	0.870
6 days	1(1.1)	1(1.1)	1(1.1)	
7 days	1(1.1)	1(1.1)	-	
10 days	-	-	1(1.1)	
Death				
Yes	16(17.2)	4(4.3)	2(2.2)	<0.001
No	16(17.2)	22(23.7)	33(35.5)	
Atrioventricular Blocks				
Nil	24(25.8)	22(23.7)	31(33.3)	
1st Degree	3(3.2)	3(3.2)	3(3.2)	
Mobitz Type 1	1(1.1)	-	-	0.668
Mobitz Type 2	1(1.1)	-	-	
3rd Degree	3(3.2)	1(1.1)	1(1.1)	

Taking into account mortality no statistical signi-ficance was observed in age (*p*=0.488), gender (*p*=0.567), duration of symptoms (*p*=0.259) parameters. However, death rates were statistically significant with diabetes (*p*=0.026) and duration of stay (*p*=0.02) of the patients. Moreover, patients treated with PCI had lower incidence of death (*p*<0.001). Patients with

higher Killip class (*p*=<0.001), higher degree of AV block (*p*=0.078) on presentation and increased no of coronary vessels involved (*p*=0.014) also showed high mortality. There was also increased death rates in patients with increased amplitude of ST elevation on ECG (*p*= 0.083) and with lower EF values (*p*=0.032) as shown in Table-III.

Table-III: Comparison of Various Parameters with Mortality

Parameters	Mortality		p-value
	Yes (n=22) n(%)	No (n=71) n(%)	
Age Groups			
20-40 years	2(2.2)	3(3.2)	
41-60 years	10(10.8)	41(44.1)	0.488
>60 years	10(10.8)	27(29.0)	
Gender			
Male	16 (17.2)	56 (60.2)	
Female	6 (6.5)	15 (16.1)	0.567
Duration of Hospital Stay			
1 day	6(6.5)	2(2.2)	
2 days	15(16.1)	54(58.1)	
3 days	1(1.1)	5(5.4)	
4 days	-	4(4.3)	0.02
6 days	-	3(3.2)	
7 days	-	2(2.2)	
10 days	-	1(1.1)	
Duration of Symptoms			
<12 hours	18(19.4)	62(66.7)	
12-24 hours	1(1.1)	6(6.5)	0.259
>24 hours	3(3.2)	3(3.2)	
Diabetes Mellitus			
Yes	14(15.1)	25(26.9)	
No	8(8.6)	46(49.5)	0.026
Atrioventricular Blocks			
Nil	15(16.1)	62(66.7)	
1st Degree	3(3.2)	6(6.5)	
Mobitz Type 1	1(1.1)	-	0.078
Mobitz Type 2	1(1.1)	-	
3rd Degree	2(2.2)	3(3.2)	
KILLIP Class			
I	2(2.2)	40(43.0)	
II	2(2.2)	13(14.0)	
III	9(9.7)	12(12.9)	<0.001
IV	9(9.7)	6(6.5)	
Treatment			
Medical	16(17.2)	16(17.2)	
SK	4(4.3)	22(23.7)	<0.001
PCI	2(2.2)	33(35.5)	
Angiography			
SVCAD	1(1.1)	24(25.8)	
DVCAD	1(1.1)	6(6.5)	
TVCAD	2(2.2)	10(10.8)	0.014
Not Done	18(19.4)	31(33.4)	
Age in years (Mean±SD)	60.54±13.68	59.71±11.43	0.778
QRS Duration (Seconds)	198.18±93.38	211.54±100.43	0.581
ST Elevat Magnitude (mV)	3.59±1.74	4.48±2.12	0.083
Ejection Fraction (%)	23.57±5.50	26.12±4.48	0.032

DISCUSSION

Right bundle branch block is a recognized complication of Anterior wall MI. Our study showed that male patients depict a more significant trend in developing RBBB. The study by Hashim *et al.* also reported an incidence of around 80% in males. According to our findings, the majority of our study participants were between the ages of 41 and 60, indicating that conduction abnormalities are more common in older patients suffering from anterior wall MI.[14] A study on healthy persons with RBBB found that they had poor outcomes, including higher risk of MI and mortality, and that male gender and older age were strong predictors of a poor prognosis in such patients, according to the outcomes.[15] Older age group involvement with BBB can be explained by structural changes in the conduction system leading to fibrosis and chronic ischemic milieu, which is often found in such individuals.[16]

Diabetes was the most commonly observed comorbid followed by hypertension and smoking in our study group. People with diabetes also had a significant increase in mortality rates in our study group. The study by Bordalo *et al.* showed that the prevalence of diabetes was 56% in RBBB compared to 36% in RBBB free patients, and death rates were also significantly higher with new-onset RBBB in people with diabetes.[17]

Although the length of stay was found to be significantly associated with death, the duration of having symptoms was not. This implies that early treatment of myocardial infarction is extremely important in preserving myocardium, regardless of the time duration of symptoms, which is a subjective evaluation of the patient and can be misleading in many cases. After conducting their investigation, Widimsky *et al.*[18] concluded that new-onset RBBB should be evaluated for immediate revascularization in the presence of suspicion of ischemia. This conclusion has since been integrated into contemporary guidelines for STEMI therapy.

We observed that among different therapeutic modalities employed in treatment, PCI was associated with a significant decrease in mortality rates ($p=< 0.001$) while patients kept on medical treatment had most deaths. Additionally, duration of stay ($p=0.87$), presence of AV blocks ($p=0.66$) and types of RBBB ($p= 0.14$) were not significantly affected by the mode of treatment. Study by Anggraeni *et al.*[19] also supported this observation and suggested that aggressive approach should be employed when reperfusion is con-templated even in patients with conduction disturbances owing to significant reduction with more aggressive therapy. Post hoc analysis of inter group comparison showed only statistically significant difference between medical and PCI groups.

In our study, transient RBBB was seen in 64.5 % and persistent RBBB in 35.5% of the patients. Iwasaki *et al.* showed a frequency of permanent RBBB 53.6% and transient RBBB 46.4%.[20] Islam *et al.* observed frequency of permanent RBBB 63.65% and transient RBBB 36.37%. Evidence suggests that conduction disturbances seen transiently are associated with extensive ischemia but are reversible and result from inflam-matory responses observed around the surrounding specialized conduction tissue. Rapid resolution of RBBB in MI has been described and more recently has been linked with thrombolytic therapy. Early coronary reperfusion could interrupt the advance of myocardial ischemia and salvage the conduction system from extensive dysfunction.[21]

Electrocardiographic parameters of ST-segment elevation were related to increased deaths, while the duration of QRS and types of RBBB were not. A recent study,[22] showed that short-term mortality was higher in permanent RBBB than transient RBBB. Similar findings were reported in another work by Ibanez *et al.* who showed that persistent RBBB is an independent risk of mortality.[23] Matthias *et al.* demonstrated that increased deaths were not seen in isolated RBBB; instead, these were high when RBBB was associated with increased ST-segment elevation.[24] We believe that a series of confounding factors may explain the prognostic influence of RBBB in AMI. We found AV blocks to be associated with mortality. Auffret *et al.* on the contrary showed that patients having high grade AV Block although had high death rates but it was not an independent predictor of mortality.[25]

The procedure was performed on 44 patients, with the majority of them having SVCAD, followed by DVCAD. The results of angiography were shown to be strongly linked with hospital death rates. Furthermore, we discovered that EF was a independent predictor of death. Another investigation came to the same conclusion as the first. In the subgroup analysis of RBBB, we were unable to detect a statistically significant connection with the Killip class. This can be explained by the fact that this pathophysiological process is dynamic in nature and is impacted by a variety of circumstances.

LIMITATIONS OF STUDY

The present study has certain limitations. Since the patients were evaluated when they landed at the hospital, it was difficult to define the time of RBBB, which may be a source of selection bias, so drawing results on clinical outcomes needs to be done cautiously because the revealed associations may not reflect actual causal links. Our study also had a small group of patients in each treatment arm, so whether these conclusions can be extrapolated on a larger group needs to be further investigated. The timing of performing PCI in the patients also varied so that this factor can be a source of bias in relation to the outcomes.

CONCLUSION

This study showed that poor outcomes in AWMI with RBBB is associated with duration of stay, presence of co morbid, Killip class, complexity of coronary artery disease amplitude of ST elevation and patients who were managed with medical therapy.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:
IZ: Concept, Design, proof reading, data collection
MK: Data collection, data interpretation and proof reading
AP: Manuscript drafting, proof reading and critical review
AM: Literature review, proof reading and editing
MA:Manuscript drafting,literature review,data interpretation
AK: Proof reading, data analysis and review of article
AS: Drafting the manuscript, proof reading & critical review
AH: Intellectual contribution, formatting and critical review

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Li J, Li X, Dong S. Clinical characteristics and value in early reperfusion therapy for new onset right bundle branch block in patients with acute myocardial infarction. Exp Ther Med 2018; 15(1): 2620–2626.
2. Erne P, Iglesias JF, Urban P. Left bundle-branch block in patients with acute myocardial infarction: Presentation, treatment, and trends in outcome from 1997 to 2016 in routine clinical practice. Am Heart J 2017; 184(1): 106–113.
3. Roffi, CM. Patrono, Collet JP, ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation, Eur. Heart J 2016; 37(1): 267–315.
4. Timoteo AT, Mendonca T. Prognostic impact of bundle branch block after acute coronary syndrome. Does it matter if it is left of right? Int J Cardiol Heart Vasc 2019; 22(1): 31–34.
5. Sarker S, Chowdhury AW, Sabah KM, Amin MG, Ali M, Saha BP, et al. In-hospital Outcome of Patients Presenting with Acute Anterior STEMI with Complete Right Bundle Branch Block. Cardiovascular Journal 2018; 11(1): 31-38.
6. Hollander G, Nadiminti V, Lichstein E, Greengart A, Sanders M. Bundle branch block in acute myocardial infarction. Am Heart J 1983; 105(1): 738-743.
7. Neumann JT, Sorensen NA, Rubsamen N. Right bundle branch block in patients with suspected myocardial infarction. Eur Heart J Acute Cardiovasc Care 2019; 8(1): 161–166.
8. Timoteo AT, Mendonca T. Prognostic impact of bundle branch block after acute coronary syndrome. Does it matter if it is left of right? Int J Cardiol Heart Vasc 2019; 22(1): 31–34.
9. Juárez-Herrera Ú, Jerjes Sánchez C, González-Pacheco H, Martínez-Sánchez C. In-hospital outcome in patients with ST elevation myocardial infarction and right bundle branch block: A sub-study from RENASICA II, a national multicenter registry. Archivos de cardiología de México 2010; 80(3): 154-158.
10. Wang J, Luo H, Kong C, Dong S, Li J, Yu H, et al. Prognostic value of new-onset right bundle-branch block in acute myocardial infarction patients: a systematic review and meta-analysis. Peer J 2018; 12(6): e4497.
11. Thygesen K, Alpert JS, Jaffe AS, Chaitman BR, Bax JJ, Morrow DA et al. Fourth universal definition of myocardial infarction (2018). European heart journal 2019; 40(3): 237-269.
12. Ibanez B, James S, Agewall S, Antunes MJ. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). European heart journal 2018; 39(2): 119-177.
13. Surawicz B, Childers R, Deal BJ, Gettes LS. AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram: part III: intraventricular conduction disturbances a scientific statement from the American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; the American College of Cardiology Foundation; and the Heart Rhythm Society endorsed by the International Society for Computerized Electrocardiology. J Am Coll Cardiol 2009; 53(11): 976-981.
14. Hashim M, Zeb S, Shah GA, Rizvi SNH. Inhospital mortality in patients of ST elevation MI presenting with right bundle branch block Pak Heart J 2017; 50(04): 241-247.
15. Bussink B E, Holst A G, Jespersen L. Right bundle branch block: prevalence, risk factors, and outcome in the general population: results from the Copenhagen City Heart Study. Eur Heart J 2013; 34(1): 138–146.
16. Neeland IJ, Kontos MC. Evolving considerations in the management of patients with left bundle branch block and suspected myocardial infarction. J Am Coll Cardiol 2012; 60(1): 96–105.
17. Bordalo ÁDB, Bordalo-Sá AL, Correia MJ, Ribeiro C. Intraventricular conduction defects in acute myocardial infarction. What is the influence of primary coronary angioplasty on their prognosis? Vascul Dis Ther 2018; 3(1): 1-5.
18. Widimsky P, Rohac F, Stasek J, Kala P, Rokyta R, Kuzmanov B, et al. Primary angioplasty in acute myocardial infarction with right bundle branch block: should new onset right bundle branch block be added to future guidelines as an indication for reperfusion therapy? European Heart Journal 2012; 33(1): 86–95. doi 10.1093/eurheartj/ehr291.

19. Anggraeni AD, Andrianto A, Dewi IP, Mulia EP, Ratri AK. Poor Outcome of Right Bundle Branch Block Coexist with ST-Elevation Myocardial Infarction. Heart Science J 2022; 3(1): 43-47.

20. Iwasaki J, Kono K, Katayama Y, Takahashi N, Takeuchi K, Tanakaya M. Prognostic Significance of Right Bundle Branch Block in Patients with Acute Inferior Myocardial Infarction. Acta Med Okayama 2009; 63(1): 25-33.

21. Islam MN, Ali MA, Saha GK, Islam MF, Islam KQ, Rahman MS. Incidence and Prognostic Significance of Right Bundle Branch Block Complicating Acute Myocardial Infarction. Bangladesh Med Res Counc Bull 2002; 28(no.1): 26-35.

22. Pera VK, Larson DM. New or presumed new left bundle branch block in patients with suspected ST-elevation myocardial infarction. Eur Heart J Acute Cardiovasc Care 2018; 7(1): 208–217.

23. Ibanez B, James S, Agewall S. ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the Management of Acute Myocardial Infarction in Patients Presenting with ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J 2018; 39(1): 119–177.

24. Matthias R, Radovanovic D, Pedrazzini G, Rickli H, Roffi M. Differences in presentation and clinical outcomes between left or right bundle branch block and ST segment elevation in patients with acute myocardial infarction, European Heart Journal. Acute Cardiovascular Care 2020; 9(8): 848–856.

25. Auffret V, Loirat A, Leurent G. High-degree atrioventricular block complicating ST segment elevation myocardial infarction in the contemporary era. Heart 2016; 102(1): 40–49

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