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±19.93 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.

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INTRODUCTION

Acute Coronary syndrome, particularly St Elevation Myocardial Infarction (STEMI), is considered one of the most common causes of death throughout the world. 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. 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.

RBBB is less commonly seen in STEMI patients with a reported incidence of 6-10%. 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.

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. In recent years, however, with the introduction of reperfusion methods like thrombolysis and percutaneous...
intervention, investigations have revealed a range of inconsistent results. According to certain studies, the death rate in Anterior Wall Myocardial Infarction patients who present with LBBB is higher when compared to those who present with RBBB, 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 ≥2 mm (0.2 mV) in men or ≥1.5 mm (0.15 mV) in women from leads V1-V6.\(^12\) RBBB was defined with QRS duration greater than 120 msec 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 at least 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 50 ms 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 \(n=\sqrt{2\times(p)\times(1-p)}\times\alpha^2\), 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, comorbidity, 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 continuous 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 5.54±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(%) | Percentage (%) |
|-----------------------|--------------|----------------|
| Males                 | 72           | 77.4%          |
| Age Groups            |              |                |
| 20-40 years           | 5            | 5.4%           |
| 41-60 years           | 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)| 208.3±498.48 | -              |
| ST Elevation Magnitude| 4.28±2.06    | -              |
| Duration of Hospital Stay | 2.38±1.39 | -              |
| Ejection Fraction     | 25.5±4.48    | -              |

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

| Parameters           | Treatment | p-value |
|----------------------|-----------|---------|
| Duration of Stay     |           |         |
| 1 day                | Medical n(%) | 2(2.2) | 1(1.1) | 0.870 |
| 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) |         |
| 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) | 0.668 |
| 1st Degree           | 3(3.2) | 3(3.2) | 3(3.2) |         |
| Mobitz Type 1        | 1(1.1) | -       | -       |         |
| Mobitz Type 2        | 1(1.1) | -       | -       |         |
| 3rd Degree           | 3(3.2) | 1(1.1) | 1(1.1) |         |

Taking into account mortality no statistical significance 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) | No (n=71) |         |
|                      | n(%)      | n(%)    |         |
| Age Groups            |           |         |         |
| 20-40 years           | 2(2.2)    | 3(3.2)  | 0.488   |
| 41-60 years           | 10(10.8)  | 41(41.1)|         |
| >60 years             | 10(10.8)  | 27(29.0)|         |
| Gender                |           |         |         |
| Male                  | 16(17.2)  | 56(60.2)| 0.567   |
| Female                | 6(6.5)    | 15(16.1)|         |
| 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)  |         |
| 6 days                | -         | 3(3.2)  |         |
| 7 days                | -         | 2(2.2)  |         |
| 10 days               | -         | 1(1.1)  |         |
| Diabetes Mellitus     |           |         |         |
| Yes                   | 14(15.1)  | 25(26.9)|         |
| No                    | 8(8.6)    | 46(49.5)|         |
| Atrioventricular Blocks |         |         |         |
| Nil                   | 15(16.1)  | 62(66.7)|         |
| 1st Degree            | 3(3.2)    | 6(6.5)  | 0.026   |
| Mobitz Type 1         | 1(1.1)    | -       |         |
| Mobitz Type 2         | 1(1.1)    | -       |         |
| 3rd Degree            | 2(2.2)    | 3(3.2)  |         |
| KILLIP Class          |           |         |         |
| I                     | 2(2.2)    | 40(43.0)| <0.001  |
| II                    | 2(2.2)    | 13(14.0)|         |
| III                   | 9(9.7)    | 12(12.9)|         |
| IV                    | 9(9.7)    | 6(6.5)  |         |
| Treatment             |           |         |         |
| Medical               | 16(17.2)  | 16(17.2)| <0.001  |
| SK                    | 4(4.3)    | 22(23.7)|         |
| PCI                   | 2(2.2)    | 33(35.5)|         |
| Angiography           |           |         |         |
| SVDV                  | 1(1.1)    | 24(25.8)| 0.014   |
| DVCAD                 | 1(1.1)    | 6(6.5)  |         |
| TVCAD                 | 2(2.2)    | 10(10.8)|         |
| Not Done              | 18(19.4)  | 31(33.4)|         |
| Age in years (Mean±SD)| 60.5±13.68| 59.7±11.43| 0.778   |
| QRS Duration (Seconds)| 198.18±53.38| 211.5±100.43| 0.581 |
| ST Elevation Magnitude (mV) | 3.59±1.74| 4.48±2.12| 0.083 |
| Ejection Fraction (%) | 23.5±4.50 | 26.1±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. 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. 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.

Diabetes was the most commonly observed comorbidity 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.

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. 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. 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%. 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 inflammatory 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.

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, 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. 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. 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.

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 morbidity, Killip class, complexity of coronary artery disease amplitude of ST elevation and patients who were managed with medical therapy.

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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.

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