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FREQUENCY OF IN-HOSPITAL MORTALITY IN PATIENTS PRESENTING WITH STEMI AND CONCURRENT RIGHT BUNDLE BRANCH BLOCK

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ABSTRACT

Objective: To examine the in-hospital mortality rates of ST segment elevation myocardial infarction patients with and without right bundle branch block.

Methods: This cross-sectional study, aimed to investigate in-hospital mortality among individuals aged ≥18 suffering from STEMI without and with RBBB diagnosed based on specific ECG criteria. Exclusions included hemodynamic instability or documented COVID-19. Ethical approval and informed consent were obtained. Data on demographics, anthropometrics, and in-hospital mortality was obtained from 209 patients via a non-probability consecutive sampling technique and analyzed using IBM-SPSS v.26, employing appropriate statistical tests.

Results: In our study (n = 209), males comprised 123 (58.9%), with 148 (70.8%) aged 45 years and older. Notably, 127 (68.8%) fell within the 30-34.99 kg/m2 BMI range. The mean age was 51.27 ± 7.02 years, reflecting a relatively young cohort. In-hospital mortality stood at 22 (10.5%). A statistically significant association ($p<0.001$) of mortality was noted with STEMI and concurrent RBBB as well as higher BMI. Also, a significant association ($p<0.001$) was observed between higher BMI and mortality (survivors mean BMI = 32.57 ± 3.31 kg/m2) and non-survivors mean BMI = 35.88 ± 2.96 kg/m2), as well as BMI categories and mortality, especially in patients suffering from STEMI.

Conclusion: RBBB significantly exacerbates the clinical severity and in-hospital mortality in patients with STEMI, particularly among a younger demographic typically underrepresented in such studies. Therefore, demographic characteristics such as age and BMI should be considered when assessing risk and tailoring treatment strategies for STEMI patients, especially those with concurrent RBBB.

Keywords: Acute coronary syndrome, acute myocardial infarction, right bundle branch block, in-hospital mortality, STEMI

INTRODUCTION

Acute myocardial infarction (AMI) is a leading cause of death in advanced nations, impacting over three million people worldwide [1]. This condition includes two primary classifications: non-ST-segment elevation myocardial infarction (NSTEMI) and ST-segment elevation myocardial infarction

(STEMI) [2]. Unstable angina, which is closely associated with NSTEMI, does not exhibit increased levels of cardiac markers [3]. Within the context of individuals with AMI, a significant 70% of fatal occurrences result from the blockage by atherosclerotic plaques [4]. Atherosclerosis, a leading cause of AMI, highlights the significance of addressing modifiable risk factors, which account for 90% (in men) and 94% (in women) of heart attacks [5]. The modifiable factors encompassed in this list are cigarette smoking, physical inactivity, diabetes, hypertension, obesity, cholesterol levels, low-density lipoprotein (LDL), and triglyceride levels. Conversely, age, sex, and family history are non-modifiable risk factors for atherosclerosis [5, 6]. Having a co-existing STEMI with a right bundle branch block (RBBB) is a rare and complicated clinical situation in the field of cardiology. The elevation of the ST segment on an electrocardiogram, which indicates STEMI, denotes a severe lack of blood flow to the heart muscle [2]. RBBB, which is an electrocardiographic sign of slowed electrical conduction across the right bundle branch, makes the cardiovascular situation even more complicated [4]. Because of how these two things interact, people are interested in the prognosis and outcomes of patients who show this specific electrocardiographic profile. Although the prognostic consequences of ST-segment elevation myocardial infarction (STEMI) are widely recognized, the simultaneous occurrence of RBBB introduces an interesting aspect, as studies have reported quite high in-hospital mortality rates for patients with STEMI and RBBB [7]. The presence of RBBB might confuse the interpretation of electrocardiographic alterations and potentially affect prompt diagnosis and treatment [8]. Prior recommendations advised prompt angiography for suspected myocardial infarction in individuals presenting with left bundle branch block (LBBB). Nevertheless, the 2017 European Society of Cardiology (ESC) guidelines now consider left bundle branch block (LBBB) and RBBB to be equally important when it comes to ST-segment elevation [8, 9]. An in-depth analysis of patient outcomes is required when there is an intersection between STEMI and RBBB, with a specific emphasis on mortality rates during the hospital stay. It is crucial to comprehend the frequency and factors that contribute to mortality when patients are in the hospital in order to improve clinical strategies and enhance patient care. The available literature on STEMI with concurrent RBBB is noticeably limited, and the existing research frequently lacks the necessary level of detail to fully understand the complex connection between these two conditions and their combined impact on mortality. Our findings are expected to have an impact on the evaluation of RBBB in people who have STEMI, thereby influencing future therapeutic protocols. Therefore, through this research, we intend to fill this void by conducting a thorough examination of the incidence rate of in-hospital death among patients who have both STEMI and RBBB. Through careful examination of a varied group of individuals and the use of rigorous research methods, our goal is to provide insight into the complex relationship between clinical factors and patient traits that influence the final result in this unique population.

MATERIALS & METHODS

This cross-sectional study was conducted at the Department of Cardiology, Ayub Medical Teaching Institution, Abbottabad, from December 2021 to June 2023. The primary objective of the investigation was to scrutinise the incidence of in-hospital mortality among individuals aged 18 years and older presenting with STEMI without RBBB and with new onset RBBB. STEMI was identified when there was an ST segment elevation greater than 2 mm in males (or greater than 1.5 mm for females) in the anterior leads and more than 1 mm elevation in other leads. This elevation was considered in the presence of chest pain persisting for more than 30 minutes, accompanied by an increase in troponins to more than two times the upper limit. The diagnosis of RBBB was confirmed when the ECG showed a prolonged QRS complex with an RSR pattern in V1-3, a "M-shaped" QRS complex, and a wide, slurred S wave in the lateral leads (I, aVL, and V5-6) in an ECG done at the presentation to hospital. Also, previous ECGs of patients who had STEMI with RBBB were assessed to confirm the case as new onset. The final diagnoses were established by consultant cardiologists who had at least five years of post-fellowship clinical experience. For the purposes of this study, we defined in-hospital mortality as the occurrence of patient death during the hospital stay or within the specified period of 30 days of the AMI. This endpoint is crucial in assessing the immediate outcomes

and impact of the studied conditions on patient survival during this period. The sample size, determined at 208, adhered to the parameters set by the WHO sample size software, incorporating a 95% confidence interval, a 5% margin of error, and an anticipated frequency of in-hospital mortality due to STEMI with concurrent RBBB of 15.3% [7]. Employing a non-probability consecutive sampling technique, 290 participants were meticulously assessed and 209 were finally selected as the rest either had an old RBBB or had STEMI with LBBB. Participants aged between eighteen years and above of any gender, diagnosed with STEMI and new onset RBBB, were included. Exclusion criteria comprised a history of hemodynamic instability (Mean blood pressure of <60mmHg, Tachycardia: heart rate greater than 100 beats per minute, cold clammy skin, altered mental status and urine output <0.5 mL/kg/hour) or a documented COVID-19 infection. The study received the requisite ethical approval from the institutional ethics review committee. Patient data was collected after getting an informed consent from each participant after explaining them the reasons for the research and the risks and benefits associated with participation in the study. The patients were managed in accordance with established departmental protocols, and their progression was tracked until discharge. The data, which included age, gender, weight, height, and in-hospital mortality events, were recorded on a predesigned proforma. IBM-SPSS version 26 served as the analytical tool. Quantitative variables (age, weight, height, and BMI) were represented in the form of mean ± standard deviation (SD). Qualitative variables (gender, age categories, BMI categories, and in-hospital mortality) were documented as frequencies and percentages. The stratification of in-hospital mortality by age, gender, and BMI categories was subjected to a post-stratification student's t test and a chi-square test where appropriate, with statistical significance deemed at a p-value of ≤ 0.05.

RESULTS

Table 1 summarizes the demographic and clinical characteristics of our study population. Gender distribution shows male predominance 134 (64.1%). Most of our patients 148 (70.8%) aged 45 years and above, with 188 (89%) having BMI > 30 kg/m^2. The majority 188 (90.0%) experienced STEMI, while only 21 (10.0%) patients presented with STEMI with concurrent RBBB of new onset. Mortality rates shows that only 22 (10.5%) patients succumbed to the acute health condition. The mean age of our patients was 51.27 ± 7.02 years and mean BMI was 32.92 ± 3.42 kg/m2. Table 2 shows the comparison of the demographic and clinical characteristics of the patients for the categories of mortality. As can be seen, statistically significant association of mortality was seen with higher mean BMI and BMI ≥30 K/m^2 ($p<0.001$) and with STEMI and concurrent RBBB ($p<0.001$). These findings suggest potential associations between higher BMI, STEMI with concurrent RBBB and mortality risk. Table 3 presents mortality analysis by age and gender categories and types of myocardial infarction (STEMI and STEMI with RBBB). Mortality rates are compared across age groups (≥45 years and <45 years) for each infarction type. Results show no significant difference in mortality rates between age and gender categories for STEMI alone group and STEMI with RBBB group. These findings offer valuable insights into mortality patterns concerning age, gender and infarction types, aiding in clinical decision-making and risk assessment.

Table 1: Demographic and clinical characteristics of our study population

Categorical Parameters		**N (%)**
Gender	Male	123 (58.9%)
	Female	86 (41.1%)
Age Categories	≥45 years	148 (70.8%)
	<45 Years	61 (29.2%)
BMI Categories (Kg/m^2)	BMI <30	23 (11.0%)
	BMI 30-34.99	127 (68.8%)
	BMI ≥ 35	59 (28.2%)

Infarction Category	STEMI	188 (90.0%)
	STEMI with RBBB	21 (10.0%)
Mortality	No	187 (89.5%)
	Yes	22 (10.5%)
Continuous Parameters		**Mean ± SD**
Age (Years)		51.27 ± 7.02
Weight (Kg)		86.59 ± 5.90
Height (m)		1.67 ± 0.09
BMI (Kg/m^2)		32.92 ± 3.42

Table 2: Comparison between mortality and patient characteristics

		Mortality		Total	P Value
		No	Yes		
Age	≥45 years	130	18	148	0.171
	<45 Years	57	4	61	
Gender	Male	110	13	123	0.981
	Female	77	9	86	
BMI (Kg/m^2)	BMI < 30	23	0	23	N/A
	BMI 30-34.99	120	7	127	
	BMI > 35	44	15	59	
STEMI or STEMI with RBBB	STEMI	174	14	188	<0.001
	SETMI with RBBB	13	8	21	
		Mortality	N	Mean ± SD	P Value
Age (Years)		No	187	51.04 ± 6.98	0.168
		Yes	22	53.23 ± 7.23	
BMI		No	187	32.57 ± 3.31	<0.001
		Yes	22	35.88 ± 2.96	

Table 3: Mortality analysis by Age and Gender categories and type of myocardial infarction

STEMI or STEMI with RBBB			Mortality		Total	P value
			No	Yes		
STEMI	Age Categories	≥45 years	121	11	132	0.477
		<45 Years	53	3	56	
SETMI with RBBB	Age Categories	≥45 years	9	7	16	0.340
		<45 Years	4	1	5	
Total	Age Categories	≥45 years	130	18	148	0.230
		<45 Years	57	4	61	
STEMI	Gender Categories	Male	100	8	108	0.981
		Female	74	6	80	
SETMI with RBBB	Gender Categories	Male	10	5	15	0.477
		Female	3	3	6	
Total	Gender Categories	Male	110	13	123	0.981
		Female	77	9	86	

DISCUSSION:

STEMI represents a critical emergency requiring immediate intervention [10]. The presence of RBBB

complicates the clinical scenario, introducing challenges in diagnosis and implications for patient management and outcomes [11]. Our study confirms and extends the findings of previous research, emphasizing the severity of STEMI when accompanied by RBBB, a condition associated with poor prognosis including increased in-hospital mortality and complications such as heart failure and complete heart block, which may necessitate the use of a permanent pacemaker [7, 12]. Our results related to the increased mortality resonates with findings of a systematic review and meta-analysis which reported that RBBB was associated with significantly increased overall mortality in patients with AMI, with an odds ratio of 1.56 for deaths [13]. Additionally, a study on risk stratification of patients with acute anterior myocardial infarction reported a lower 30-day mortality rate for those with persisting RBBB if ST-segment elevation had resolved by ≥ 50% [14]. Furthermore, the presence of RBBB in patients with AMI was associated with a greater incidence of heart failure and a statistically significant increase in in-hospital mortality [15].

Our analysis revealed a significant association between higher BMI and increased mortality, particularly in patients with STEMI. This is consistent with existing literature that associates adverse outcomes in myocardial infarction with obesity [16, 17]. However, our study contributes new insights into this relationship by emphasizing the critical impact of RBBB on these outcomes. Unlike many studies which consider older populations, our cohort included a relatively younger demographic, with a mean age of 51.27 ± 7.02 years, reflecting the shifting epidemiology of myocardial infarction to younger populations possibly due to lifestyle factors, genetic predispositions, or earlier onset of cardiovascular risk factors. Studies have reported mean age from 59.91 ± 11.93 years to 67.9 ± 12.8 years [10, 17, 18]. However, specific age-related outcomes and their impact on mortality would require a closer examination.

Our study focused on patients with STEMI and thus provides novel data on the occurrence and outcomes of RBBB complicating STEMI in current times. The evaluation of mortality outcomes in our study, with 10.5% of patients not surviving the acute period after hospitalization for myocardial infarction, reflects the severity of the condition. Studies focusing on mortality outcomes in AMI patients having concurrent RBBB have reported mortality in range of 8.64% to 54.3% [15, 18-21]. In comparing our results with existing data, we observe some consistency in the prevalence of RBBB and its impact on mortality. Shrivastav et al. has reported the frequency of In-hospital mortality of 15.3% in patients presenting with STEMI with RBBB while Meyer et al. reported the frequency of In-hospital mortality to be significantly higher in the group of patients with RBBB 8.6% vs. 3.7% in patients without RBBB (p=0.034) [7, 15]. Another study also reported a considerably greater in-hospital mortality rates for patients STEMI patients with RBBB compared to those without RBBB (15.3% vs. 9.2%; P< .0001) [20]. They also reported that AMI with concomitant RBBB was an independent risk factor for mortality (adjusted odd ratio 5.14; 95% confidence interval: 3.90-6.70). In their patients, the concomitant presence of RBBB with STEMI was found to be related with a 66% higher risk of mortality within 30 days of hospitalization (hazard ratio, 1.66; 95% confidence interval, 1.52-1.81; P < 0.0001).

In our cohort, while RBBB was observed across a range of ages, the lower mean age showing most of the affected patients to be young, provided unique insights into how these presentations vary from typical patterns observed in older populations. The independence of RBBB from age challenges traditional perceptions and highlights the need for a nuanced approach to diagnosing and managing younger patients with such complex presentations. By examining these relationships, our study contributes new perspectives to the existing body of knowledge, suggesting that age alone should not dictate the anticipated clinical course in STEMI with RBBB, thereby informing more tailored and effective therapeutic strategies. Our study adds to this by analyzing the interaction between demographic characteristics (age and BMI) and clinical outcomes, highlighting how younger patients with higher BMI may experience different risk profiles.

Furthermore, the prevalence of male patients in our study aligns with widely reported trends that men are more frequently affected by STEMI than women [16, 17]. This observation supports the need for targeted public health interventions and awareness programs focusing on cardiovascular risk factors in men, especially as they age. It is also indicative of potential genetic and biological factors that may predispose men to more severe forms of coronary artery disease.

Regarding treatment implications, our findings underscore the importance of rapid and effective management strategies for STEMI patients with concurrent RBBB. The complexity of managing such cases demands enhanced clinical vigilance and possibly innovative treatment protocols to mitigate the increased risk of mortality and severe outcomes. It is imperative that future clinical guidelines consider these nuances to improve prognosis and management outcomes in this high-risk patient population.

CONCLUSIONS:

Our study highlights that RBBB significantly exacerbates the clinical severity and in-hospital mortality in patients with STEMI, particularly among a younger demographic typically underrepresented in such studies. Our findings underscore the importance of considering demographic characteristics such as age and BMI when assessing risk and tailoring treatment strategies for STEMI patients, especially those with concurrent RBBB. Enhanced clinical awareness and proactive management are crucial in mitigating the adverse outcomes associated with this complex cardiac event. Future research should continue to explore the demographic factors influencing STEMI outcomes to refine risk stratification models and improve therapeutic approaches.

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