Frequency of complete heart block (CHB) and its association with hypertension and diabetes mellitus in patients with anterior wall myocardial infarction (AWMI).

Abstract

Background: The presence of conduction defects complicates AMI frequently and is associated with increased short and long term mortality rates. The occurrence of complete heart block in anterior wall myocardial infarction is important because it indicates that infarction is extensive and may result in cardiac failure or death.

Objective: To determine the frequency of complete heart block (CHB) in patients presented with anterior wall myocardial infarction (AWMI).

Material and Methods: Total 152 patients with AWMI were included. The history of the patients was taken regarding hypertension, diabetes mellitus, smoking, family history of CAD, and chronic kidney disease. Study outcome, complete heart block, was assessed and recorded.

Results: There were 81.6% male and 18.4% female patients. Mean age was 56.25±9.81 years. Total 9.2% patients were found with chronic kidney disease. In our study, 12.5% patients were found with complete heart block. Significant association of complete heart block was observed with hypertension and diabetes mellitus while no significant association was observed with gender, age, smoking, CAD family history, and chronic kidney disease.

Conclusion: Our study results showed 12.5% patients observed complete heart block. Hypertension and diabetes mellitus are found as the significant risk factors of complete heart block.

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Keywords: Acute Myocardial Infarction, Complete Heart Block, Anterior Wall Myocardial Infarction.

Introduction:

Myocardial infarction, is a leading cause of death worldwide.[1] Acute myocardial infarction (AMI) is caused by occlusion of blood flow in the coronary arteries supplying the myocardium.[2] Not only the myocardium but also the conducting system get devoid of the blood supply in AMI which leads to bradycardia and arrhythmias.[3]

The presence of conduction defects complicates AMI frequently and is associated with increased short and long term mortality rates. Thrombolytic therapy, although, has been established to reduce the mortality in AMI however its role in reducing the incidence of conduction defects is less clearly defined. Complications associated with conduction defects have remained unchanged.[4]

Risk factors are often shown to be strongly connected with each other while preventive ones are found to be correlated. We can say that those who already have significant health risks are more prone to get additional risk factors, and that they are fewer prone to always have prevention strategies. [4]

The most commonly observed conduction defects after acute MI include atrioventricular nodal blocks (1st, 2nd and 3rd degree) and intraventricular conduction defects (right or left bundle branch block). In some cases fascicular blocks (anterior and posterior hemi-blocks) alone or in combination with right bundle branch block (bi-fascicular blocks) are also observed. The occurrence of complete heart block in AWMI is important because it indicates that infarction is extensive and may result in cardiac failure or death.[5]

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However, the presence of CHB points to seriously jeopardized AV conduction which could result in sudden extremely slow heart rates or asystolic arrest. Study by Bilal et al,[6] showed that out of 54 cases of acute MI, Complete Av block was present in 11.8%, left BBB in 14.7%, and right BBB 8.8%. All patients with complete block died and mortality was significantly higher in patients with heart blocks. As compared to another study by Bhalliet al[7] showed even more higher rate of conduction defects as only cases with anterior MI were included AV block was reported in 11.1% of the patients with AWMI. GUSTO-1 study by Sgarbossa et al.[8]

It showed higher incidence of cardiac failure in patients of BBB along with mortality. Moreno et al[9] study showed morbidity and mortality in 40% in patients of RBBB & 64% in patients of LBBB with anterior wall MI, which they found statistically significant. Mahreen S et al.[10] conducted a study in local population and reported AV block in 28% of the patients with inferior wall MI.

The mortality associated with AWMI with CHB is alarmingly high. Moreover, early diagnosis and treatment knowing its considerable high mortality can be life-saving and increase the patient's life expectancy and quality of life. Although management of such patients with acute myocardial infarction complicated by complete heart block is a significant clinical problem it still needs good clinical understanding of the problem for improving survival. However, very limited data is available in context of Pakistani population regarding the topic of concern. With varying disease penetration, awareness, lifestyle, and literacy rate we are expecting to see differences in our population as compare to the western world. Under the light of above mentioned data, we planned the present study to determine the frequency CHB in patients presented with AWMI. This will surely be a benchmark study for further researches in optimal treatment plan for such patient with AWMI and CHB.

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Methods:

Study Settings:

The cross-sectional study was conducted in Adult Cardiology Department, National Institute of Cardiovascular Diseases (NICVD), Karachi from December 2019 to December 2020.

Sample size:

Sample size was calculated using WHO sample size calculator version 2.0 with the Confidence interval of 95%, margin of error: 5%, required sample size was152

Selection criteria of the patients Selected for the study:

Patients with 40 and above years of age presenting with AWMI of either gender were included in this study while patients with previous history of valvular heart disease (VHD) were excluded.

DATA COLLECTION.

The study was started after approval from ethical review committee of NICVD Karachi. Data was collected from patients presented at Adult Cardiology Department of National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan, with Anterior Wall Myocardial Infarction (AWMI) from those who were falling in the inclusion criteria. Prior to inclusion the purpose, and benefits of the study was explained to all participants/attendants of patients and written informed consent was taken by the research team. Demographic profile of the patients like gender and age was recorded. History of the patients was taken regarding hypertension, diabetes mellitus, smoking, family history of CAD, and chronic kidney disease (CKD). Study outcome i.e. complete heart block (CHB), was assessed and recorded and association was checked with study variables.

OUTCOME ANALYSIS AND RECORD:

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Data were entered and analyzed using SPSS version-21. Shapiro-Wilk test was applied to check the hypothesis of normality for age (years) and descriptive statistics such as mean±SD, median (IQR), maximum and minimum were calculated appropriately. Frequency and percentages were calculated for categorical variables such as gender, age group, hypertension, diabetes mellitus, smoking, family history of CAD, chronic kidney disease (CKD), and complete heart block (CHB). Effect modifiers like age groups, gender, hypertension, diabetes mellitus, smoking, family history of CAD, and chronic kidney disease (CKD) were controlled through stratification. Post stratification chi-square test or fisher exact test was applied. Two sided p-value of ≤ 0.05 was taken as criteria of statistical significance.

Results:

Total 152 patients of either gender with age 40 years to 80 years meeting inclusion criteria of study were evaluated to determine the frequency of complete heart block (CHB) in patients presented with anterior wall myocardial infarction (AWMI).

Among 152 patients, 81.6% were male and 18.4% were female, mean age of participants was 56.25±9.81 years. Age was divided into two sub-groups i.e. ≤ 55 years and > 55 years. In 152 patients, it was observed that 63 (41.4%) patients were hypertensive and 36 (23.7%) patients were diabetic while 59 (38.8%) patients were found to be smokers and 15 (9.9%) had family history of CAD and chronic kidney disease was found in 14 (9.2%). In our study, 152 patients who presented with anterior wall MI, 19 (12.5%) of them were found to have complete heart block (table 1).

Stratification with respect to age, gender, hypertension, diabetes mellitus, smoking, CAD family history and chronic kidney disease was done to observe effect of these modifiers on complete heart block. P-value ≤ 0.05 was considered as significant.

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Our study showed significant association of complete heart block with hypertension (p=0.002) and diabetes mellitus (p=0.043). No significant association of complete heart block was found with gender (p=0.343), age group (p=0.500), smoking (p=0.753), CAD family history (p=0.355) and chronic kidney disease (p=0.289) (table 02).

Variable		n	%
Age	**≤ 55 years**	78	51%
	> 55 years	74	49%
Gender	**Female**	28	18.4%
	Male	124	81.6%
Diabetes	**Yes**	36	23.7%
	NO	116	76.3%
Hypertension	**Yes**	63	41.4%
	NO	89	58.6%
Family History of CAD	**Yes**	15	9.9%
	NO	137	90.1%
Smoking Status	**Yes**	59	38.8%
	NO	93	61.2%
Chronic Kidney Disease	**Yes**	14	9.2%
	NO	138	90.8%
Complete heart Block	**Yes**	19	12.5%
	NO	133	87.5%

Table 1: Demographic characteristics of participants (n=152)

Variables		Complete heart block		Total	P value
		Yes	No		
Age	**≤ 55 years**	11 (14.3)	66 (85.7)	**77**	0.500
	> 55 years	8 (10.7)	67 (89.3)	**75**	
Gender	**Female**	14 (11.3)	110 (88.7)	**124**	0.343
	Male	5 (17.9)	23 (82.1)	**28**	
Diabetes	**Yes**	8 (22.2)	28 (77.8)	**36**	0.043*
	NO	11 (9.5)	105 (90.5)	**116**	
Hypertension	**Yes**	14 (22.2)	49 (77.8)	**63**	0.002*
	NO	5 (5.6)	84 (94.4)	**89**	
Family History of CAD	**Yes**	3 (20)	12 (80)	**15**	0.355
	NO	16 (11.7)	121 (88.3)	**137**	

Smoking Status	**Yes**	8 (13.6)	51 (86.4)	**59**	0.753
	NO	11 (11.8)	82 (88.2)	**93**	
Chronic Kidney Disease	**Yes**	3 (21.4)	11 (78.6)	**14**	0.298
	NO	16 (11.6)	122 (88.4)	**138**	

Table 2: Stratification of variables with respect to complete heart block (n=152)

** Significant association found*

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Discussion:

Several complications may occur in the first few days following anterior wall MI including mechanical complications such as heart failure, cardiogenic shock, ventricular aneurysms, ventricular septal rupture (VSR) , LV thrombus and mitral regurgitation (MR); ischemic complications such as infarct extensions ; thromboembolic complications such as limb ischemia, renal infarction, pulmonary embolism and stroke; arrhythmic complications such as supraventricular tachycardia, atrial fibrillation, atrioventricular blocks, ventricular premature beats, ventricular tachycardia and ventricular fibrillation and inflammatory complications such as pericarditis.[12]

Myocardial infarction (MI) is the irreversible necrosis of heart muscle secondary to prolonged ischemia. It is considered more appropriately a part of a spectrum referred to as Acute Coronary Syndrome (ACS), which includes ST- elevation MI (STEMI), non–ST-elevation MI (NSTEMI) and[66] unstable angina. Acute myocardial infarction (MI) is a common medical emergency and is the leading cause of death worldwide.[7]

This study was conducted in a tertiary care hospital to evaluate the frequency of complete heart block (CHB) in patients presented with anterior wall myocardial infarction (AWMI). Mean age of our patients was 56.25±9.81 years. This was comparable as described by Bhalli MA et al. in a local study conducted at Abbott Abad which shows that mean age of patients with acute Myocardial infarction in this era was around 59 years.[12]

There were 81.6% male and 18.4% female patients in our study population. This was again found in other studies for acute ant wall MI, like one study did by Khan S et al, who studied 340 patients and found 75 % Male, which is close to findings in our study. [11]

In a study there were 2.9 % patients who developed complete heart block. In our study 12.5% patients were found with complete heart block. This finding was supported by Escosteguy CC et al, who found that the incidence of CHB in Anterior MI is 2.8%. Same frequency was noted by Bhalli MA et all who studied 174 cases of Anterior MI and found 5 cases of CHB (2.87%).[72,74] Gupta MC et al and Norris RM found high frequency of CHB in Anterior MI that is 8.6 % and 5 % respectively.[75,76] This might be, because these studies were performed in pre thrombolytic era. So present study also favor that incidence of CHB is reduced in thrombolytic era as compared to pre thrombolytic era. In previous studies reduce incidence of CHB in thrombolytic era was found as compared to pre thrombolytic era.[02]

Among 124 male patients, 14(11.3%) developed complete heart block, where as in 28 female patients, 5 (17.9%) developed complete heart block. Though there was high frequency of CHB in Male patients but was statistically insignificant. Shirafkani A et al, also found that there is no

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difference in both sexes regarding CHB. Patients who develop CHB in our study population were categorized into Two age groups. The frequency of CHB was 14.3% in age group ≤55 years and 10.7% in age group >55 years but was statistically insignificant. Shirafkhani A et al found that there is no significant statistical correlation between the incidence of heart blocks and the patient's age.

In a study those patients who presented with anterior wall MI, most of them (79.6%) were thrombolysed. This finding is supported by other studies in which similar percentage of thrombolytic therapy was found. Bhalli et al, found 70 % thrombolytic rate in their study.[12] In WIRE registry, Habib et al, the rate of thrombolytic therapy was 68.3 % and 68 % respectively.

There is conflicting evidence regarding the effect of thrombolytic therapy on prevention of CHB. The exact association of thrombolytic therapy with CHB is not known yet. Different studies have found different association. Khan S et al, found that the development of heart blocks is more common among those patients treated with thrombolytic therapy. This observation was not confirmed in the study of Melgare et al.[13]

In a current study, in total thrombolysis patients (n=246), 7(2.84%) develop CHB, where is in non thrombolytic group (n=63) only 2 patients (3.17%) develop CHB (p=.89). The GISSI-1 study [82] reported similar incidences of complete atrioventricular block in the streptokinase group and nonthrombolytic- treated controls respectively. Present findings are more consistent with the GISSI-1 study, because we found similar incidence of CHB in both Thrombolytic and non-thrombolytic groups.

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Conclusion:

Despite the use of thrombolytic therapy, there was a high incidence of early left ventricular infarct expansion in patients with acute anterior STEMI. This incidence can be greatly reduced by earliest reperfusion therapy within the first 3 hours of onset of symptoms of acute anterior myocardial infarction, and best early revascularization rehabilitation can maintain left ventricular systolic efficiency and prevent in-hospital death rates when particularly in comparison to late revascularization.

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

Study Limitations:

The main limitation of our study was the small sample size. Other limitations of the present study include a single-center experience. It was conducted with urban environment therefore; the results might not be generalizable to larger populations. Anterior wall myocardial infarction may lead to a number of complications including complete heart block. Our study results showed 12.5% patients with anterior wall myocardial infarction were observed complete heart block. Further, hypertension and diabetes mellitus are found as the significant risk factors of complete heart block among patients having anterior wall myocardial infarction.

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