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Original Research Article

FREQUENCY OF HIGH DEGREE ATRIOVENTRICULAR BLOCK IN PATIENTS WITH ACUTE ANTERIOR WALL MYOCARDIAL INFARCTION

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Abstract: *Atrioventricular (AV) block is an AV conduction disorder that can manifest in various settings, with varying symptomaticity and severity. Complications of acute ST-elevation myocardial infarction (STEMI) as AV blocks are often observed. The first degree of atrioventricular block is the most common and requires no treatment. The second-degree block is sub-classified in Mobitz type I and Mobitz type II. This study aimed to determine the frequency of high-degree atrioventricular block in acute anterior wall myocardial infarction cases. The current cross-sectional analysis was conducted at the Department of Cardiology, Rehmat-ul-Lil-Alameen Institute of Cardiology, Lahore, from 19-02-2021 to 18-08-2021. A total of 311 patients were enrolled in the study. Cases underwent an electrocardiogram, and high degree AV Block was labeled per operational definitions. The results were noted and recorded on the same proforma. The overall mean age of the patients was 55.6±8.4 years. Gender distribution of patients shows a higher frequency of 57.9% males compared to 42.1% females with a female-to-male ratio of 1:1.4. High degree of atrioventricular block was found among 5.8% of the total patients. Around 5.8% of AWMI patients presented with high-grade AV block in this study are in-concomitant with other studies. No association of risk factors (p-value >0.05) was presented regarding age, gender, DM, hypertension, dyslipidemia, family history of CAD, and smoking in this study.*

Keywords: High Degree Atrioventricular Block, Acute Anterior Wall Myocardial Infarction, Hypertension, DM

Introduction

The high-degree atrioventricular block is one of the uncommon complications of myocardial infarction (MI) and is underrated. Its incidence is more frequently seen in cases with inferior wall MI (8.1-28%), and data has suggested that it can happen with anterior wall ST-segment elevation MI, i.e., STEMI, and is seen in relatively lower numbers (Mehreen et al., 2016; Singh et al., 2015). Conduction abnormalities develop in about 15 % to 20% of the patients with acute myocardial infarction and predict adverse prognosis in high in-hospital mortality, hypotension, left ventricular failure, cardiogenic shock, recurrent angina, and cardiac arrest (Pokorney et al., 2016). In ST-elevation myocardial patients, early reperfusion is associated with early resolution of complete heart block and a significant reduction in in-hospital mortality from 10-15% in pre-thrombolytic to 6-10 % in thrombolytic. This decline is explained by a short therapeutic window (6 hours). Five percent of the patients who receive thrombolytic therapy develop late-onset complete heart block (Pokorney et al., 2016).

In some cases, complete Atrioventricular blocks due to myocardial infarction are transient and reversible with a mean duration of 3.8 days (range 1-13 days), mostly reverting to normal sinus rhythm in the first 48 hours of the onset of complete atrioventricular block.5lnterventions in the form of reperfusion, i.e., percutaneous transluminal coronary angioplasty helps in early resolution of (Pokorney et al., 2016; Shaffer et al., 2014) atrioventricular block even in anterior MI. A temporary pacemaker is life-saving for symptomatic Atrioventricular block patients; if not responding to atropine, not needed in all patients, and the permanent pacemaker is needed in 4.7 % of patients of acute (Pokorney et al., 2016) myocardial infarction and rarely needed in inferior M1 (Cardoso et al., 2016; Ullah et al., 2019). According to a Farman Ullah et al. study, high-end AV block was seen in 7 (5.34%) out of 131 cases with AWMI (Ullah et al., 2019). High-degree AV block is relatively uncommon in AWMI and can be missed if the threshold for detection is low. Early detection and prompt intervention in the form of reperfusion or pacemaker can be helpful in reducing the morbidity

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and mortality in such cases. The aim of this study was to determine the frequency of high degree atrioventricular block in cases with acute anterior wall myocardial infarction.

Methodology

The current cross-sectional analysis was conducted at the Department of Cardiology, Rehmat-ul-Lil-Alameen Institute of Cardiology, Lahore, from 19-02-2021 to 18-08-2021. The sample size is calculated as 311 by keeping the confidence interval equal to 95%, the margin of error equal to 2.5%, and the anticipated prevalence of high-end AV block in cases of AWMI as 5.34% (Ullah et al., 2019). The cases of acute anterior wall myocardial infarction presenting within 24 hours of symptoms as per operational definition were recruited in this study. Both genders, aged 40-70 years, were included. At the same time, the cases with electrolyte imbalance, i.e., below normal or above normal serum potassium, calcium, and magnesium (as per medical record), documented cases with a history of chronic liver, renal or cardiac disease (assessed by history and medical record) were excluded from the study. The ethical review committee of the hospital approved this study. After that, informed consent was taken, and data were acquired in the form of gender (male/female), age (years), duration of AWMI (Hours), DM (yes/no), HTN (yes/no), smoking (yes/no), family history of CAD (yes/no) and were recorded on a proforma. Then these cases underwent an electrocardiogram, and high degree AV Block was labeled per operational definitions. The results were noted and recorded on the same proforma.

The data was analyzed with the help of SPSS version 21.0. Quantitative variables were presented as mean ± SD (Standard Deviation) for age and duration of AWMI. Frequency and percentages were calculated for qualitative variables like gender, DM, HTN, smoking, family history of CAD, and outcome variables, i.e., High degree AV block detected as yes or no. Effect modifiers were controlled through stratification of gender, age, duration of AWMI, DM, HTN, Smoking, and family history of CAD to see the effect on the outcome variable. Post-stratification chi-square test was applied. P-value ≤0.05 was taken as significant.

Results

A total of 311 patients aged 40 and above were included in this study, of which 31.5% were in the age group of 40-50 years, while the rest of 68.5% were in the age group of ≥ 51 years with an overall mean age of 55.6±8.4 years. Duration of onset of AWMI was also assessed and segregated as patients reached a health facility in ≤ 12 hrs or > 12 hrs which remained at 73% and 27%, respectively, while the mean time of onset remained to be 9.2±6.1 hrs (Table 1).

Table 1 Distribution of patients by age and duration of AWMI

Variables	Constructs	Number	Percentage
Age (Year)	40-50	98	31.5
	≥ 51	213	68.5
Duration of AWMI (hrs)	≤ 12 hrs	227	73.0
	> 12 hrs	84	27.0

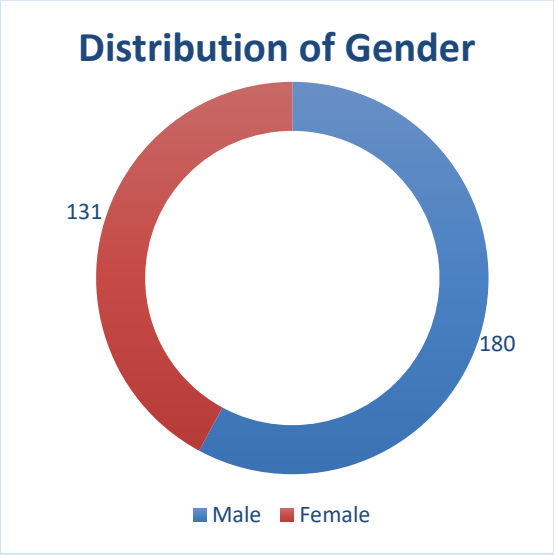

Figure 1 Distribution of Gender

Gender distribution of patients shows a higher frequency of 57.9% males compared to 42.1% females, with female to male ratio of 1:1.4 (Figure 1). A history of diabetes mellitus was present in 36.3% of AWMI patients, while the rest, 63.7%, were nondiabetic. A history of hypertension was also noted among AWMI patients and found to be 45.7%. Similarly, 57.9% of patients were smokers, 46.9% had a positive family history of CAD, and dyslipidemia in 40.5% of cases (Table 2). Distribution of patients with reference to the high degree of atrioventricular block was found to be present among 5.8% of the total recruited cases, as depicted in Figure 2. Stratification of AWMI patients was analyzed for age groups, gender, and duration of onset of AWMI, history of DM, Hypertension, and smoking with reference to the high degree AV block, which showed a no significant difference (Table 3).

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Table 2 Comorbid conditions of the study population

Comorbid conditions	Yes (n, %)	No (n, %)
Diabetes	113 (36.3%)	198 (63.7%)
Hypertension	142 (45.7%)	169 (54.3%)
Smoking	180 (57.9%)	131(42.1%)
Family history of CAD	146 (46.9%)	165 (53.1%)
Dyslipidemia	126 (40.5%)	185 (59.5%)

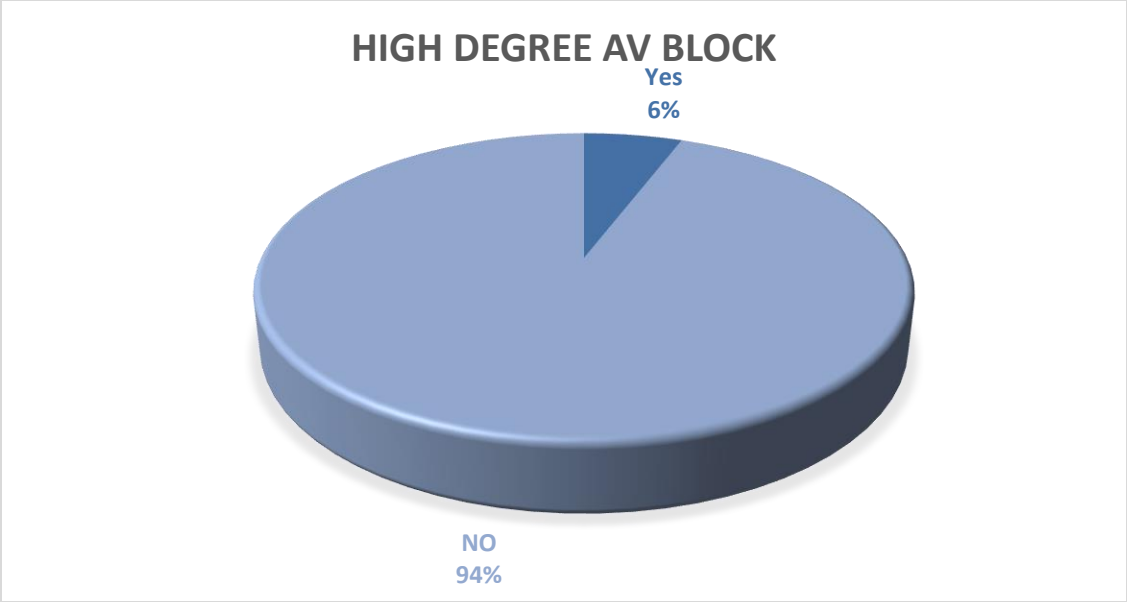

Figure 2 Frequency of high degree AV block

Table 3 Stratification of the variable with reference to High degree AV block

Variables	Constructs	High-degree AV block		p-value
		Yes	No	
Age	40-50	7	91	0.488
	≥ 51	11	202	
Gender	Male	12	168	0.437
	Female	6	25	
Duration of AWMI (hrs)	≤ 12	12	215	0.534
	> 12	6	78	
History of DM	Yes	7	106	0.816
	No	11	187	
Hypertension	Yes	9	133	0.703
	No	9	160	
Smoking	Yes	12	168	0.437
	No	6	125	

Discussion

AV blocks are most commonly classified by severity. A first-degree AV block is defined by a prolonged P-R interval > 200 ms with no greater degrees of the block. A second-degree AV block can be further stratified into Mobitz Type I, in which there is a gradual prolongation of the P-R interval in succeeding

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beats leading to a non-conducted P wave, and Mobitz Type II, in which the P-R intervals for conducted P waves are the same before and after a non-conducted P wave 09. Complete heart block is often the result of the same causes as Mobitz type 1 and Mobitz type 2. Other causes include inferior MI, degeneration of the conduction system, and AV-nodal blocking agents such as beta-blockers, non-dihydropyridine calcium channel blockers, adenosine, digitalis, and amiodarone. Patients with complete heart block are at great risk of developing asystole, ventricular tachycardia, and sudden cardiac death. Insertion of a permanent pacemaker is required 10. A study on high-grade AV block described two cases and used ECG for diagnosing and managing patients 09 is consistent with present analysis as the same methodology was used to find the high-grade AV block cases amongst AWMI patients.

The present study analyzed a total of 311 patients aged 40 and above were included in this study of which 31.5% were in the age group of 40-50 years, while the rest of 68.5% were in the age group of ≥ 51 years with an overall mean age of 55.6±8.4 years, amongst them higher numbers of (180) 57.9% were males as compared to (131) 42.1% females with female to male ratio of 1:1.4. A high degree of AV block which was found to be present among (18) 5.8% of total cases. Another study from Pakistan registered 150 patients, presenting a lower mean age of 50.44 ± 6.7 years. Among them, 112 patients (74.7%) were male, and 38 patients (25.3%) were female, with a variable female-to-male ratio. Out of 150 patients, 107 patients (71.3%) had anterior wall MI, 19 patients (12.7%) had posterior wall MI, and 19 patients (12.7%) had inferior wall MI whereas the rest of 5 patients (3.3%) showed positive results for lateral wall MI. In our study sample, 112 patients (81.3%) had no AV Block, 19 patients (12.7%) showed type 1 AV Block, 7 patients (4.7%) had type 2 AV Block, and 2 patients (1.3%) had type 3 AV Block. Female patients with anterior wall MI are at risk of developing AV blocks (Kashou et al., 2021). Results are somehow comparable with present findings, with variable degrees of controversial findings in some respects. Results of the above study presented female gender is more prone to develop high-grade AV block (Dar et al., 2015) is not in agreement with the present study as an insignificant difference (p=0.437) is noted in this study pertaining the gender has no relation with occurrence of high-grade AV block. An older study included 2073 STEMI patients identified through a hospital register and the Danish National Patient Register. Both registers were also used to establish the diagnosis of HAVB. All-cause mortality was the primary endpoint. During a median follow-up of 2.9 years [interquartile range (IQR) 1.8–4.0], 266 patients died. The high-degree atrioventricular block was documented in 67 (3.2%) patients, of whom 25 died. Significant independent predictors of high-grade AV block included right coronary artery occlusion, age >65 years, female gender, hypertension, and diabetes. The adjusted mortality rate was significantly increased in patients with HAVB compared to patients without HAVB [hazard ratio = 3.14 (95% confidence interval 2.04–4.84), P< 0.001] (Gang et al., 2012). A landmark analysis 30 days post-STEMI showed equal mortality rates in the two groups. Again the findings are not concomitant with present findings as no significant differences (p-value >0.05) regarding age, hypertension, diabetes, etc., were presented. A French study aimed to analyze incidence, clinical correlation and impact on in-hospital outcomes of high grade AV block in a large prospective registry (Observatoire Régional Breton sur l'Infarctus, ORBI) of modern management of STEMI with a special focus on potential differences between patients with HAVB on admission and those who developed HAVB during hospitalization. The study recruited 6662 patients (age: 62.0 (52.0–74.0) years; male: 76.3%) included in the present analysis. HAVB was documented in 3.5% of patients, present % on admission in 63.7%, and occurring % during hospitalization in 36.3%. Patients with HAVB on admission or occurring during the first 24 h of hospitalization had higher in-hospital mortality rates (18.1% and 28.6%, respectively) than patients without (4.5%) or with HAVB occurring beyond the first 24 h of hospitalization (8.0%). However, by multivariable analysis, HAVB was not independently associated with in-hospital mortality contrarily to age, presentation as cardiac arrest, anterior STEMI location, reperfusion therapy, cardiogenic shock, mechanical ventilation, and occurrence of sustained ventricular tachyarrhythmias or mechanical complication (Auffret et al., 2016). Thus, comparable findings are depicted in the present study. A recent study from California undertook a question, "Are there readily modifiable risk factors associated with the risk of high-grade AV block?" and presented the findings of a cohort analysis which included 6146 community-dwelling individuals, elevated blood pressure and blood glucose levels were associated with the development of AV block. Population-attributable risk calculations suggest that elevated blood pressure and glucose levels may be associated with more than half of all cases of AV block. Results elaborated those women; mean [SD] age, 49.2 [12.9] years), 529 (8.6%) had ECG evidence of conduction disease, and 58 (0.9%) experienced a hospitalization with AV block. Older age (hazard ratio [HR] per 5-year increment, 1.34; 95% CI, 1.16-1.54; P < .001), male sex (HR, 2.04; 95% CI, 1.19-3.45; P = .01), a history of myocardial infarction (HR, 3.54; 95% CI, 1.33-9.42; P = .01), and a history of congestive heart failure (HR, 3.33; 95% CI, 1.10-10.09; P = .03) were each independently associated with AV block. Two

modifiable risk factors were also independently associated with AV block. Every 10–mm Hg increase in systolic blood pressure was associated with a 22% higher risk (HR, 1.22; 95% CI, 1.10-1.34; P = .005), and every 20-mg/dL increase in fasting glucose level was associated with a 22% higher risk (HR, 1.22; 95% CI, 1.08-1.35; P = .001). Both risk factors remained statistically significant (HR for systolic blood pressure, 1.26 [95% CI, 1.06-1.49; P = .007]; HR for glucose level, 1.22 [95% CI, 1.04-1.43; P = .01]) after adjustment for major adverse coronary events during the follow-up period. In population-attributable risk assessment, an estimated 47% (95% CI, 8%-67%) of AV blocks may have been avoided if all participants exhibited ideal blood pressure, and 11% (95% CI, 2%-21%) may have been avoided if all had a normal fasting glucose level (Kerola et al., 2019). Results are not associated with the present study's findings as this study did not present any association of blood pressure and DM with high-grade AV block. Singh et al. (Singh et al., 2015), in a study on high-grade AV block in acute coronary syndromes: insights from the global registry of acute coronary events presented the clinical characteristics, in-hospital therapies, and outcomes that were compared between patients with and without high-grade AV block. Factors associated with death in patients with high-grade AV block were determined. A total of 59 229 patients with ACS between 1999 and 2007 were identified; 2.9% of patients had high-grade AV block at any point during the index hospitalization; 22.7% of whom died in hospital [adjusted OR = 4.2, 95% confidence interval, 3.6–4.9, P < 0.001]. The association between high-grade AV block and in-hospital death varied with the type of ACS [OR: STEMI = 3.0; non-STEMI = 6.4; unstable angina = 8.2, P for interaction < 0.001]. High grade AV block present at the time of presentation to hospital (vs. occurring in-hospital) and early (<12 h) percutaneous coronary intervention or fibrinolysis (vs.>12 h or no intervention) were associated with improved in-hospital survival, whereas temporary pacemaker insertion was not. Patients with high grade AV block surviving to discharge had similar adjusted survival at 6 months compared with those without high grade AV block. A reduction in the rate of, but not in-hospital mortality associated with, high grade AV block was noted over the study period (Singh et al., 2015). Hospital mortality rate was not calculated in present study but no association of occurrence of high grade AV block was reported presently among patients reached hospital facility within 12 hours of onset of symptoms or later.

Conclusion

Around 5.8% of AWMI patients presented with high-grade AV block in this study are in-concomitant with other studies. No association of risk factors (p-value >0.05) was presented regarding age, gender, DM, hypertension, dyslipidemia, family history of CAD, and smoking in this study.

Conflict of interest

The authors declared an absence of conflict of interest.

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