FREQUENCY OF ATRIOVENTRICULAR BLOCK IN PATIENTS PRESENTING WITH ACUTE CORONARY SYNDROME AND TO COMPARE THE OUTCOME IN PATIENTS WITH OR WITHOUT ATRIOVENTRICULAR BLOCK

Nauman Saleem[a]*, Sajjad Ahmad[a], Zohaib Sadiq[a], Gulshan Ahmad[a], Jawad Ahmed[a], Salman Munir[b]

[a]Punjab Institute of Cardiology, Lahore, [b]Rehbar Rangers Medical College, Lahore.

Date of Submission: 16-11-2021; Date of Acceptance: 16-12-2021; Date of Publication: 31-05-2022

ABSTRACT:

BACKGROUND:
In some cases of acute inferior wall myocardial infarction, atrioventricular (AV) block is known to be reversible. AV block is associated with certain complications which leads to emergency care and hospitalization. [1]

AIMS & OBJECTIVE:
The objective of the study was to establish the frequency of atrioventricular block in patients presenting with acute coronary syndrome (ACS) and to compare the outcome in patients with or without atrioventricular block.

MATERIAL & METHODS:
This cross sectional study was carried-out at the department of Cardiology, Punjab Institute of Cardiology, Lahore over a period of six months from October 2017 to March 2018. Patients were screened for AV block. During hospital stay, patients were assessed for congestive heart failure, cardiogenic shock, cardiac arrest and mortality. Patients with and without AV block were compared by using chi-square test.

RESULTS:
In our study, the mean age of patients was 61.00±11.75years. There were 242 (50.4%) males while 238 (49.6%) females. Out of 480 patients, AV block was present in 95 (19.8%) patients while 385 (80.2%) patients did not develop AV block. Congestive heart failure was present in 50 (52.6%) patients with AV block while in 62 (16.1%) patient without AV block. Out of 57 patients, cardiogenic shock was present in 27 (28.4%) patients with AV block while in 30 (7.8%) patients without AV block. Cardiac arrest was present in 34 (35.8%) patients with AV block while in 42 (10.9%) patient without AV block. Death occurred in 28 (29.5%) patients with AV block while in 19 (4.9%) patients without AV block. The difference was significant ($p<0.05$) for all outcomes in both groups.

CONCLUSION:
The frequency of AV block was although low in ACS patients but the complications were significantly high.

KEY WORDS:
Atrioventricular block, acute coronary syndrome, cardiogenic shock, cardiac arrest, congestive heart failure, death.

Correspondence : Nauman Saleem, Jinnah Hospital Lahore. Email: naumangilani164@hotmail.com

INTRODUCTION

Acute coronary syndrome (ACS) is a term in which clinical symptoms are associated with acute myocardial ischemia i.e and unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI).[1, 2]

It is seen that in some cases of acute IWMI, complete atrioventricular (AV) block is reversible. The high-grade AV block is rarely reversible in non-MI coronary artery disease.[3] AV block occurs when impulse generated at SA node causing atrial depolarization is either delayed at AV node or when it fails to reach the ventricles, AV block occurs. Three degrees of AV block are known.[4]

In 0.5-2% of healthy individual first-degree AV block can exist and its prevalence inclines with age. PR interval may exceed 0.20 seconds in at the age of 20 years while it can exceed 0.20 seconds in more than 5% at the age of 60 years. These days AV block is well managed due to the recent advances in diagnostics and pacing therapies.[5]

One multicenter study reported that the AV block occurs in 2.9% patients of ACS. Patients with AV block experienced more in-hospital complications including congestive heart failure (30.6 vs 12.8%, P<0.001), cardiogenic shock (23.3 vs. 3.5%, P< 0.001), cardiac arrest (24.5 vs. 4.1, p<0.001) and mortality (22.7 vs. 4.3%, p<0.001).[6]

Rationale of current study was to assess the frequency of AV block in patients with ACS and the outcome of patients with or without AV block. Literature has shown that frequency of AV block is very low but in routine AV block seems to be more common.

MATERIAL AND METHODS:

This cross sectional study was performed at the department of Cardiology, Punjab Institute of Cardiology, Lahore over a period of six months from October 2017 to March 2018. Patients were screened for AV block. During hospital stay, patients were assessed for congestive heart failure, cardiogenic shock, cardiac arrest and mortality. The statistical analysis of data was done by using SPSS version 21. Patients with and without AV block were compared by using chi-square test.

Total 480 patients were enrolled with 95% confidence level, 1.5% margin of error and taking expected percentage of AV block in patients presenting with ACS. Non-probability, consecutive sampling. Patients of age 40-80 years of either gender presenting with ACS (as per operational definition) in emergency within 12 hours of symptoms were included. Patients with previous MI, CABG, PCI (on medical record) and patients having liver problem (ALT>40IU, AST>40IU), abnormal kidney function (creatinine>1.2mg/dl) or asthma were excluded from the study.

OPERATIONAL DEFINITION:

ACS:

Acute coronary syndrome (ACS) refers to a spectrum of clinical presentations ranging from those for ST-segment elevation myocardial infarction (STEMI) to presentations found in non–ST-segment elevation myocardial infarction (NSTEMI) or in unstable angina. It is almost always associated with rupture of an atherosclerotic plaque and partial or complete thrombosis of the infarct-related artery.

AV block:

It was diagnosed if prolonged PR interval (>0.20sec) on ECG, if Mobitz 1; with each successive QRS P-R interval increased until there is non-conductive P-wave or Mobitz 2; AV conduction ratio varies between 2:1 and 3:1 or variable PR interval with an escape rhythm, atrial rate is faster than escape rhythm, no relation between atria and ventricle, HR<40bpm.

Adverse Outcomes:

It was assessed during first 7days of hospital stay. Assessment was done daily
1.Congestive heart failure: It was classified if there waspresence of dyspnea, tiredness, swelling or edema of lower limbs (any one or more) along with BNP>100pg/dl and EF<40% on echocardiography.
2.Cardiogenic shock: It was identified if there was decreased cardiac output (EF<40%), blood pressure <90mmHg for at least 30 minutes and evidence of tissue hypoxia.
3.Cardiac arrest: It was characterized if there wasabrupt loss of heart function on clinical evaluation.
4.Death occurred: If patient died (no heartbeat, no respiration) on clinical examination during first 7 days of admission

480 patients who fulfilled the selection criteria were enrolled in the study from the emergency of Department of Cardiology, Punjab Institute of Cardiology, Lahore. Informed consent was obtained from attendants. Demographic data (name, age, gender, BMI, duration of symptoms, type of ACS and history of diabetes (BSR>186mg/dl)) was also noted. Patients were screened for AV block (as per operational definition). Patients were followed-up in cardiology ward for 7 days. During follow-up, patients were assessed for congestive heart failure, cardiogenic shock,

cardiac arrest and mortality during hospital stay (as per operational definition). The collected data was analysed statistically by using SPSS version 21. Quantitative variables like age, BMI and duration of symptoms were presented in form of mean ± S.D. Qualitative variables like gender, diabetes, AV block and outcome (congestive heart failure, cardiogenic shock, cardiac arrest and mortality during hospital stay) were presented in form of frequency and percentage. Patients with and without AV block were compared by using chi-square test. P-value≤0.05 was considered as significant. Data was stratified for age, gender, BMI, duration of symptoms, type of ACS and diabetes. Post-stratification, chi-square test was applied to check significance in stratified groups. P-value≤0.05 was considered as significant.

RESULTS:

In this study, the mean age was 61.00±11.75 years (Table 1). There were 242 (50.4%) males while 238 (49.6%) females (Fig 1). The mean duration of symptoms was 7.97±2.59hours (Table 2) There were 312 (65.0%) diabetic patients (Fig 2). In this study, 281 (58.5%) patients presented with STEMI while 199 (41.5%) had NSTEMI (Fig 3). AV block was present in 95 (19.8%) patients while 385 (80.2%) did not develop AV block (Table 3). Congestive heart failure was identified in 50 (52.6%) patients with AV block while in 62 (16.1%) patient without AV block. The difference was significant (p<0.05) (Table 4). Cardiogenic shock was present in 27 (28.4%) patients with AV block while in 30 (7.8%) patient without AV block. The difference was significant (p<0.05) (Table 5). Cardiac arrest was present in 34 (35.8%) patients

with AV block while in 42 (10.9%) patients without AV block. The difference was significant (p<0.05) (Table 6). Death occurred in 28 (29.5%) patients with AV block while in 19 (4.9%) patients without AV block. The difference was significant (p<0.05) (Table 7). Data was stratified for effect modifiers and congestive heart failure was compared in both AV block groups. The frequency of congestive heart failure was significantly high in patients with AV block in both age groups, genders, duration of symptoms, diabetes and type of ACS (p<0.05) (Table 8). Data was stratified for effect modifiers and cardiogenic shock was compared in both AV block groups. The frequency of cardiogenic shock was significantly high in patients with AV block in both age groups, genders, duration of symptoms, diabetes and type of ACS (p<0.05)(Table 9).

Data was stratified for effect modifiers and cardiac arrest was compared in both AV block groups. The frequency of cardiac arrest was significantly high in patients with AV block in both age groups, genders, duration of symptoms, diabetes and type of ACS (p<0.05) (Table 10). Data was stratified for effect modifiers and death was compared in both AV block groups. The frequency of death was significantly high in patients with AV block in both age groups, genders, duration of symptoms, diabetes and type of ACS (p<0.05), except in females and duration of symptoms>8hours (P>0.05)(Table 11).

DISCUSSION:

AV conduction disturbances frequently seen in acute myocardial infarction. Within a few days, most of these types of AV conduction disturbances disappear. Occlusion of AV node branch of the
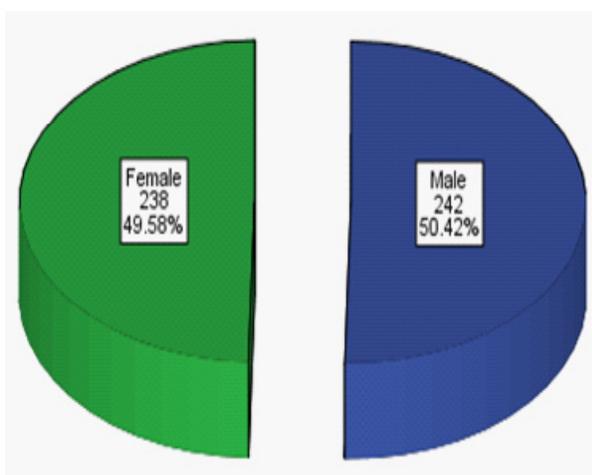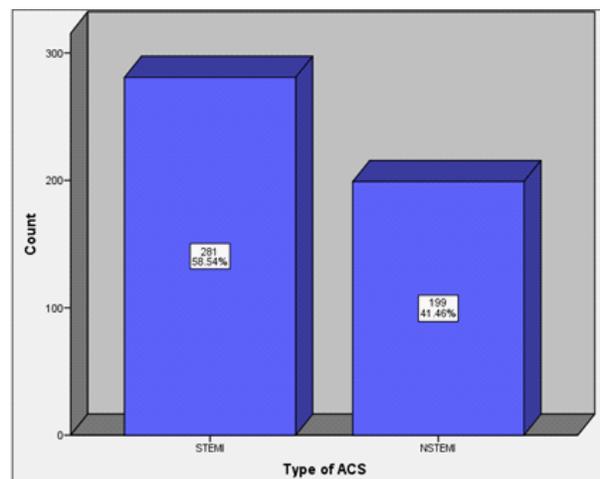

Fig 1: Distribution of gender of patients

Fig 3: Distribution of type of ACS

Table 1: Descriptive Statistics of age of patients

Age (years)	n	275
	Mean	61.00
	SD	11.75
	Minimum	40
	Maximum	80

Table 2: Descriptive Statistics of duration of symptoms

Duration (Hours)	n	275
	Mean	7.97
	SD	2.59
	Minimum	4
	Maximum	12

Table 3: Distribution of AV block

		Frequency	Percent
AV block	Present	95	19.8
	Absent	385	80.2
	Total	480	100.0

Table 4: Comparison of congestive heart failure in AV block group

		AV block		Total
		Present	Absent	
Congestive heart failure	Yes	50 (52.6%)	62 (16.1%)	112 (23.3%)
	No	45 (47.4%)	323 (83.9%)	368 (76.7%)
Total		95 (100%)	385 (100%)	480 (100%)

Chi-square test = 56.833, p-value = 0.000 (Significant)

Table 5: Comparison of cardiogenic shock in AV block group

		AV block		Total
		Present	Absent	
Cardiogenic shock	Yes	27 (28.4%)	30 (7.8%)	57 (11.9%)
	No	68 (71.6%)	355 (92.2%)	423 (88.1%)
Total		95 (100%)	385 (100%)	480 (100%)

Chi-square test = 30.986, p-value = 0.000 (Significant)

Table 6: Comparison of cardiac arrest in AV block group

| | | AV block | | Total |
		Present	Absent	
Cardiac arrest	Yes	34 (35.8%)	42 (10.9%)	76 (15.8%)
	No	61 (64.2%)	343 (89.1%)	404 (84.2%)
Total		95 (100%)	385 (100%)	480 (100%)

Chi-square test = 35.395,   p-value = 0.000 (Significant)

Table 7: Comparison of death in AV block group

| | | AV block | | Total |
		Present	Absent	
Death	Yes	28 (29.5%)	19 (4.9%)	47 (9.8%)
	No	67 (70.5%)	366 (95.1%)	433 (90.2%)
Total		95 (100%)	385 (100%)	480 (100%)

Chi-square test = 51.945,   p-value = 0.000 (Significant)

Table 8: Comparison of congestive heart failure in AV block groups stratified for effect modifiers

| | | AV block | | Total | p-value |
		Present	Absent		
Age	40-60	18 (48.6%)	33 (17.1%)	51 (22.2%)	0.000
	61-80	32 (55.2%)	29 (15.1%)	61 (24.4%)	0.000
Gender	Male	28 (51.9%)	23 (12.2%)	51 (21.1%)	0.000
	Female	22 (53.7%)	39 (19.8%)	61 (25.6%)	0.000
Duration	4-8	31 (51.7%)	21 (10.8%)	52 (20.5%)	0.000
	9-12	19 (54.3%)	41 (21.5%)	60 (26.5%)	0.000
Diabetes	Yes	35 (56.5%)	32 (12.8%)	67 (21.5%)	0.000
	No	15 (45.5%)	30 (22.2%)	45 (26.8%)	0.007
Type of ACS	STEMI	50 (52.6%)	36 (19.4%)	86 (30.6%)	0.000
	NSTEMI	0 (0%)	26 (13.1%)	26 (13.1%)	NA

Table 9: Comparison of cardiogenic shock in AV block groups stratified for effect modifiers

| | | AV block | | Total | p-value |
		Present	Absent		
Age	40-60	11 (29.7%)	10 (5.2%)	21 (9.1%)	0.000
	61-80	16 (27.6%)	20 (10.4%)	36 (14.4%)	0.001
Gender	Male	15 (27.8%)	18 (9.6%)	33 (13.6%)	0.001
	Female	12 (29.3%)	12 (6.1%)	24 (10.1%)	0.000
Duration	4-8	14 (23.3%)	14 (7.2%)	28 (11.0%)	0.000
	9-12	13 (37.1%)	16 (8.4%)	29 (12.8%)	0.000
Diabetes	Yes	17 (27.4%)	13 (5.2%)	30 (9.6%)	0.000
	No	10 (30.3%)	17 (12.6%)	27 (16.1%)	0.013
Type of ACS	STEMI	27 (28.4%)	9 (4.8%)	36 (12.8%)	0.000
	NSTEMI	0 (0%)	21 (10.6%)	21 (10.6%)	NA

Table 10: Comparison of cardiac arrest in AV block groups stratified for effect modifiers					
		AV block		Total	p-value
		Present	Absent		
Age	40-60	17 (45.9%)	21 (10.9%)	38 (16.5%)	0.000
	61-80	17 (29.3%)	21 (10.9%)	38 (15.2%)	0.001
Gender	Male	14 (25.9%)	21 (11.2%)	35 (14.5%)	0.007
	Female	20 (48.8%)	21 (10.7%)	41 (17.2%)	0.000
Duration	4-8	20 (33.3%)	26 (13.4%)	46 (18.1%)	0.000
	9-12	14 (40.0%)	16 (8.4%)	30 (13.3%)	0.000
Diabetes	Yes	21 (33.9%)	26 (10.4%)	47 (15.1%)	0.000
	No	13 (39.4%)	16 (11.9%)	29 (17.3%)	0.000
Type of ACS	STEMI	34 (35.8%)	20 (10.8%)	54 (19.2%)	0.000
	NSTEMI	0 (0%)	22 (11.1%)	22 (11.1%)	NA

Table 11: Comparison of death in AV block groups stratified for effect modifiers					
		AV block		Total	p-value
		Present	Absent		
Age	40-60	9 (24.3%)	7 (3.6%)	16 (7.0%)	0.000
	61-80	19 (32.8%)	12 (6.3%)	31 (12.4%)	0.000
Gender	Male	22 (40.7%)	7 (3.7%)	29 (12.0%)	0.001
	Female	6 (14.6%)	12 (6.1%)	18 (7.6%)	0.060
Duration	4-8	24 (4.0%)	8 (4.1%)	32 (12.6%)	0.000
	9-12	4 (11.4%)	11 (5.8%)	15 (6.6%)	0.215
Diabetes	Yes	18 (29.0%)	7 (2.8%)	25 (8.0%)	0.000
	No	10 (30.3%)	12 (8.9%)	22 (13.1%)	0.001
Type of ACS	STEMI	28 (29.5%)	5 (2.7%)	33 (11.7%)	0.000
	NSTEMI	0 (0%)	14 (7.0%)	14 (7.0%)	NA

right coronary artery is considered to be the cause of heart block in these patients

Occlusion of the right or left circumflex coronary arteries results in acute inferior wall infarction. In 90% of the population, right coronary artery supplies the AV node artery.[3,6] Despite arterial occlusion however, pathologic studies have demonstrated little or no tissue necrosis in the AV node or His bundle of these patients. It may be due to spontaneous recanalization or dual arterial blood supply.

In our study, AV block was present in 95 (19.8%) patients while 385 (80.2%) did not develop AV block. Some healthy adults can have first degree AV block, and its incidence increases with age. PR interval may exceed 0.20 seconds in 0.5-2% of healthy people at 20 years. PR interval may exceed 0.20 seconds in more than 5% healthy individuals at age of 60 years. Improve outcome for AV block seen after recent advances in diagnostics and pacing therapies.[5] One multicenter study reported that the AV block occurs in 2.9% patients of ACS.[6]

Significant mortality in AV block patients complicates the otherwise benign course of inferior wall MI. Patients in present study have higher in-hospital mortality and higher incidence of other in hospital complications including Congestive heart failure, cardiogenic shock, cardiac arrest and mortality as compared to those without AVB.

Patients with AV block experienced more in-hospital complications including congestive heart failure (30.6 vs 12.8%, P<0.001), cardiogenic shock (23.3 vs. 3.5%, P< 0.001), cardiac arrest

(24.5 vs. 4.1, p<0.001) and mortality (22.7 vs. 4.3%, p<0.001).[6]

In a study by Gang UJO et. al, [7] twenty-five patients (3.2%) expired out of 67 patients who were documented AV block in patients presenting with STEMI. Female gender, age >65 years, diabetes and hypertension complete RCA occlusion were significant independent predictors of developing AV block.7 AV block in ACS in our study was found to be 3.2% which is 2–4% lower than reported in studies of STEMI patients in the thrombolytic era.[8,9] Nguyen et al. and Harpaz et al. findings indicate recent encouraging declines in the incidence rates of CHB complicating ACS.[10,11]

Patients with inferior infarctions having frequency of 9.4% AV block and those with anterior infarctions were having 2.5% AV block as reported in Aplin et al.8 Auffret et al., reported that 3.5% of patients were having AV block, 63.7% of patients on admission and 36.3% during hospitalization. In-hospital mortality rates (18.1% and 28.6%, respectively) were higher in patients having AV block on admission or those developing during first 24hour of hospitalization compared to those patients without (4.5%) or with AV block occurring beyond the first 24 hours of hospitalization (8.0%).[12]

Gupta et al., reported that AV block developed in 10.3% of patients with ACS. Seventeen out of 22 patients were died who were having circulatory failure alone or in combination with congestive heart failure, shock, hypotension and left ventricular failure. Out of five transvenously paced patients, four died.[13]

In a study by Feigl et al [14] second and third degree AV block was diagnosed in 37 (14%) with acute inferior (diaphragmatic) myocardial infarction in a group of 288 patients which is comparable to our study where we found 19% AV block in our study population.

We stratified data for effect modifiers and congestive heart failure, cardiogenic shock, cardiac arrest and death was compared in both AV block groups. The frequency of congestive heart failure was significantly high in patients with AV block in both age groups, genders, duration of symptoms, diabetes and type of ACS (p<0.05).

CONCLUSION

The frequency of AV block was although low in ACS patients but the complications were significantly high.

References:

1. Ramasamy I. Biochemical markers in acute coronary syndrome. Clin Chim Acta 2011;412(15):1279-96.

2. Sanon S, Patel R, Eshelbrenner C, Sanon VP, Alhaddad M, Oliveros R, et al. Acute coronary syndrome in patients with diabetes mellitus: perspectives of an interventional cardiologist. Am J Cardiol 2012;110(9):13B-23B.

3. Cardoso R, Alfonso CE, Coffey JO. Reversibility of High-Grade Atrioventricular Block with Revascularization in Coronary Artery Disease without Infarction: A Literature Review. Case Rep Cardiol 2016;2016.

4. Tracy CM, Epstein AE, Darbar D, DiMarco JP, Dunbar SB, Estes NM, et al. 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. J Am Coll Cardiol 2013;61(3):e6-e75.

5. Saleh F, Greene EA, Mathison D. Evaluation and management of atrioventricular block in children. Curr Opin Pediatr 2014;26(3):279-85.

6. Singh SM, FitzGerald G, Yan AT, Brieger D, Fox KA, López-Sendón J, et al. High-grade atrioventricular block in acute coronary syndromes: insights from the Global Registry of Acute Coronary Events. Eur Heart J 2014:ehu357.

7. Gang UJO, Hvelplund A, Pedersen S, Iversen A, Jøns C, Abildstrøm SZ, et al. High-degree atrioventricular block complicating ST-segment elevation myocardial infarction in the era of primary percutaneous coronary intervention. Europace 2012;14(11):1639-45.

8. Aplin M, Engstrøm T, Vejlstrup NG, Clemmensen P, Torp-Pedersen C, Køber L, et al. Prognostic importance of complete atrioventricular block complicating acute myocardial infarction. The American journal of cardiology 2003;92(7):853-6.

9. Meine TJ, Al-Khatib SM, Alexander JH, Granger CB, White HD, Kilaru R, et al. Incidence, predictors, and outcomes of high-degree atrioventricular block complicating acute myocardial infarction treated with thrombolytic therapy. American heart journal 2005;149(4):670-4.

10. Harpaz D, Behar S, Gottlieb S, Boyko V, Kishon Y, Eldar M, et al. Complete atrioventricular block complicating acute myocardial infarction in the thrombolytic era. Journal of the American College of Cardiology 1999;34(6):1721-8.

11. Nguyen HL, Lessard D, Spencer FA, Yarzebski J, Zevallos JC, Gore JM, et al. Thirty-year trends (1975-2005) in the magnitude and hospital death rates associated with complete heart block in patients with acute myocardial infarction: a population-based perspective. American heart journal 2008;156(2):227-33.

12. Auffret V, Loirat A, Leurent G, Martins RP, Filippi E, Coudert I, et al. High-degree atrioventricular block complicating ST segment elevation myocardial infarction in the contemporary era. Heart 2016;102(1):40-9.

13. Gupta M, Singh M, Wahal P, Mehrotra M, Gupta S. Complete heart block complicating acute myocardial infarction. Angiology 1978;29(10):749-57.

14. Feigl D, Ashkenazy J, Kishon Y. Early and late atrioventricular block in acute inferior myocardial infarction. Journal of the American College of Cardiology 1984;4(1):35-8.