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Original Research Article

Frequency of Atrioventricular Block in Patients with Acute ST Segment Elevation Myocardial Infarction

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Abstract: *Atrioventricular (AV) block is a recognized complication of acute ST-segment elevation myocardial infarction (STEMI), associated with adverse clinical outcomes. The timely identification of conduction abnormalities can assist in risk stratification and management of affected patients..* ***Objective:*** *To determine the frequency of atrioventricular block in patients with acute ST-segment elevation myocardial infarction.* ***Methodology:*** *We conducted this cross-sectional study on 104 patients aged 35 to 75 years of either gender presenting with acute STEMI (based on symptoms and ECG criteria). We determined the frequency of atrioventricular block in these patients. AV block was diagnosed through ECG (PR interval >0.20 seconds).* ***Results:*** *Mean age was 57.34±10.86 years. Fifty-eight (55.8%) were male and 46 (44.2%) were female. Nineteen (18.3%) patients had diabetes. Twenty-five (24.0%) had hypertension. Smoking was reported in 16 (15.4%) patients. The frequency of atrioventricular block in our study was 7 (6.7%).* ***Conclusion:*** *The frequency of atrioventricular block in patients with acute ST-segment elevation myocardial infarction in our study was 7 (6.7%).*
Keywords: Artioventricular block, Acute ST-elevation myocardial infarction (STEMI), Myocardial infarction (MI), Cardiac disease

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Introduction

Acute ST-segment myocardial infarction (STEMI) is an alarming outcome of coronary artery disease (CAD), which mainly affects individuals in their 6th decade of life. (1, 2) Patients below 45 years of age account for roughly 5 of total acute myocardial infarction (AMI) instances. In developing countries, AMI commonly manifests at a younger age, around ten years earlier, in contrast observed in developed nations. (3) The Middle East demonstrates a notable prevalence of STEMI, with 11% of adults having their first occurrence before the age of 40. (4) The incidences are 4% in North America, 2.7% in Europe, as well as 9.7% in Africa. (5) A STEMI results from the obstruction of at least one coronary arteries that supply blood to the heart. The abrupt disruption of blood flow usually results from plaque rupture, erosion, or fissuring. The primary risk factors for STEMI consist of dyslipidemia, diabetes, hypertension, smoking, as well as a familial history of CAD. (6, 7) Electrocardiography pointing to STEMI calls for prompt reperfusion via PCI within 120 minutes, which may lower mortality by up to 7%. (8) The cardiac conduction system consists of specialized fibers responsible for initiating as well as conducting electrical impulses throughout the heart's chambers. The primary pacemaker of the human heart is the sinus node, tasked with generating impulses that depolarize. The impulse generated by the sinus node spreads to the atria, resulting in atrial depolarization as well as subsequent contraction. (9) The atrioventricular (AV) conduction system consists of the atrioventricular node as well as specialized conduction fibers that constitute the His-Purkinje system. (10) The autonomic nervous system stimulates the AV conduction system, especially the AV node, leading to variable conduction across different physiological states. (11) An AV block denotes a delay or disruption in conduction of the impulse from the atria to the ventricles. This may result from functional impairment in the cardiac conduction system. (12) A study reported that the frequency of AV block in acute STEMI was found to be 7.3%. (13)

AV block in STEMI is often due to ischemia and can be reversible with appropriate therapy. Managing AV block effectively can improve myocardial perfusion and prevent further ischemic damage. The management of AV block in patients with acute STEMI is of paramount importance due to its potential life-threatening consequences, impact on reperfusion timing, and reversible nature. As there is no such study conducted on this subject at our local level. Therefore, the goal of this study is to determine the frequency of atrioventricular block in patients with acute STEMI. The results of this study will help medical professionals to adopt a tailored and timely approach in managing AV block in collaboration with a multidisciplinary team, which can significantly improve the clinical outcomes of STEMI patients and reduce the risk of complications.

Methodology

This study had a cross-sectional design conducted in the Department of Cardiology, Hayatabad Medical Complex, Peshawar, from 21 December 2023 to 21 June 2024 after obtaining ethical clearance from the institute. One hundred four patients were included; the sample was calculated based on the previous frequency of atrioventricular (AV) block in acute STEMI patients, 7.3% (13), 5% margin of error, and a 95% confidence level. Consecutive non-probability sampling was used to enroll patients.

Patients aged between 35 and 75 years presenting with symptoms of acute STEMI, which included chest pain (VAS >3) and shortness of breath, were considered for inclusion. Diagnosis was confirmed via electrocardiogram (ECG) showing ST-segment elevation at the J point in at least two contiguous leads with specific cutoff values, >0.1 mV in all leads except V2-V3,>0.2 mV in men over 40,>0.25 mV in men under 40, and >0.15 mV in women. Those with electrolyte imbalances, chronic liver disease, or chronic renal disease were not included.

Each patient provided consent. Demographic details such as BMI, age, gender, occupation, education level, and socioeconomic status, along with clinical variables including smoking, hypertension, and diabetes, were recorded.

To assess AV block patients who exhibited symptoms such as bradycardia, lightheadedness, and chest pain (VAS >3), underwent ECG evaluation. AV block was confirmed if the PR interval exceeded 0.20 seconds without disruption of atrial-to-ventricular conduction. All ECG interpretations were performed by a consultant cardiologist with a minimum of five years of post-fellowship experience.

Data was analyzed with SPSS 25. Numerical variables were calculated using the mean and SD. Categorical variables were evaluated using frequency and percentages. For associations, we used Chi chi-square test, keeping P notable at < 0.05.

Results

The mean age of 104 patients was 57.34 ± 10.86 years. The average body mass index (BMI) was 25.46 ± 1.30 kg/m². Around 58 (55.8%) were male and 46 (44.2%) were female (Table 1).

Regarding comorbidities, there were 19 (18.3%) patients with diabetes, and 25 (24.0%) had hypertension. Smoking was reported in 16 (15.4%) patients (Table 2). The prevalence of atrioventricular (AV) block was 7 (6.7%) (Figure 1).

We further examined the association of AV block with various parameters. Among those with AV block 5 (71.4%) were male, and 2 (28.6%) were female (p > 0.05). Diabetes showed a notable association with AV block 5 (71.4%) of the affected patients had diabetes (p < 0.05). Hypertension was more prevalent in the AV block, with 4 (57.1%) affected having hypertension (p < 0.05). Smoking was also notably associated with AV block, with 3 (42.9%) smokers having AV block (p < 0.05) (Table 3).

Table 1 Demographics

Demographics		n	%
Gender	Male	58	55.8%
	Female	46	44.2%
Education status	Literate	60	57.7%
	Illiterate	44	42.3%
Socioeconomic status	Lower class (< 50K /Month)	27	26.0%
	Middle class (50k to 100K /Month)	55	52.9%
	Upper class (> 100K /Month)	22	21.2%
Employment status	Employed	43	41.3%
	Unemployed	61	58.7%

Table 2 Comorbidities

Comorbidities		n	%
Diabetes	Yes	19	18.3%
	No	85	81.7%
Hypertension	Yes	25	24.0%
	No	79	76.0%
Smoking	Yes	16	15.4%
	No	88	84.6%

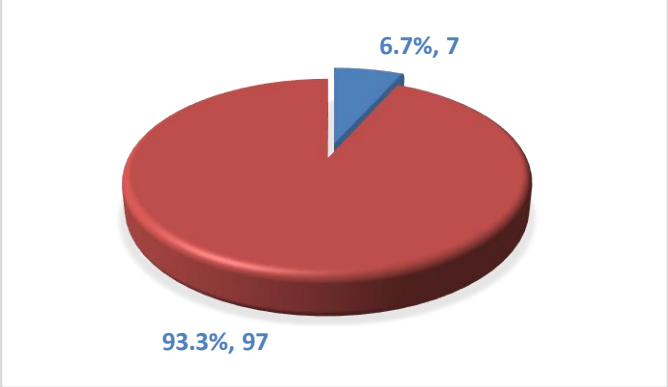

Figure 1: Frequency of AV block

Table 3: Association of AV block with various parameters

Parameters		Atrioventricular block				P value
		Yes		No		
		n	%	n	%	
Gender	Male	5	71.4%	53	54.6%	P > 0.05
	Female	2	28.6%	44	45.4%	
Diabetes	Yes	5	71.4%	14	14.4%	P < 0.05
	No	2	28.6%	83	85.6%	
Hypertension	Yes	4	57.1%	21	21.6%	P < 0.05
	No	3	42.9%	76	78.4%	
Smoking	Yes	3	42.9%	13	13.4%	P < 0.05
	No	4	57.1%	84	86.6%	

Discussion

The mean age of our patients was 57.34 ± 10.86 years, which is comparable to studies by Hashmi et al. (50.55 ± 6.72 years), Harrak et al (61.9± 7.72 years), and Dar WA et al (55.6 ± 8.4 years). (13-15). We found that male patients were higher in number compared to female patients. This demographic finding is consistent with the aforementioned studies, where male patients had a higher frequency than female patients. Among 104 patients, AV block was observed in 6.7% of cases, which aligns closely with previous studies. Hashmi et al documented the frequency of AV block 7.3% in patients with STEMI. (13) Another study, which was conducted by Harrak et al, documented around 7.37% cases of ACS being complicated by AV block. (14) Dar WA et al documented the frequency of high-degree AV block in 5.8% STEMI patients. (15) Dar UF et al reported that in their cohort, 12.7% patients had type 1 AV block, 4.7% had type 2, and 1.3% had type 3 AV block. (16)

Similarly, Khan et al documented that complete AV block in STEMI patients in their study was found in 3.3%. (17) A higher proportion for complete AV block, 12.5% was reported by Talpur et al. (18). The variation in prevalence can be attributed to differences in study populations' inclusion criteria and definitions of AV block.

A notable observation in our study was the noteworthy association between AV block and diabetes, with 71.4% of AV block patients being diabetic compared to only 14.4% in the non-AV block group. This finding seems consistent with Talpur et al, who studied 150 patients with AWMI; they found a strong link between diabetes and AV shock. (18) In contrast, Hashmi et al found no notable association between diabetes and AV block. (13) Dar WA et al also did not find an association between diabetes and AV block. (15)

Hypertension also emerged as a potential predictor of AV block in our study, affecting 57.1% of AV block cases compared to 21.6% in those without AV block. Talpur et al in their study found a notable association of hypertension and AV block, which aligns with our findings. (18) In contrast, Hashmi et al and Dar WA et al did not find such associations in their studies. (13, 15)

Smoking was another factor potentially linked to AV block in our study, with 42.9% of affected individuals being smokers compared to 13.4% in the non-AV block group. Smoking promotes endothelial dysfunction and accelerates atherosclerosis, which could further compromise blood supply to the conduction system. (19) Khan et al found a notable association of complete heart block with mortality, and among the expired patients, smoking was more prevalent. (17) In contrast, Hashmi et al and Dar WA et al did not report a notable association. (13, 15) Given the strong correlation in our data, smoking cessation programs should be emphasized for STEMI patients to lower the risk of AV block.

Our study showed that diabetes, hypertension, and smoking are potential modifiable factors for AV block in STEMI patients. Given the strong associations observed, we suggest targeted interventions such as optimized glycemic control, antihypertensive therapy, and smoking cessation programs could reduce the incidence of conduction disturbances.

Conclusion

In conclusion, the frequency of atrioventricular block in patients with acute ST-segment elevation myocardial infarction in our study was 6.7%, while AV block was notably associated with diabetes, smoking, and hypertension.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-1682)

Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AAK (Postgraduate Resident)
Data entry, Data analysis, drafting articles, Study Design, Revision of manuscript
RG (Assistant Professor)
Review of Literature and Critical Input

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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