

The Pattern of Cardiac Arrhythmias in Acute ST Elevated Myocardial Infarction and their in-hospital Outcome

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Abstract:

Background: Acute myocardial infarction (AMI) is a major cause of death worldwide with arrhythmia being the most common determinant in the post-infarction period. Identification and management of arrhythmias at an early period of acute MI has both short term and long term significance. **Objective:** The aim of the study is to evaluate the pattern of arrhythmias in acute STEMI in the first 48 hours of hospitalization and their in-hospital outcome. **Methods:** A total of 50 patients with acute STEMI were included in the study after considering the inclusion and exclusion criteria. The patients were observed for the first 48 hours of hospitalization for detection of arrhythmia with baseline ECG at admission and continuous cardiac monitoring in the CCU. The pattern of the arrhythmias during this period & their in-hospital outcome were recorded in predesigned structured data collection sheet. **Result:** The mean age was 53.38 ± 10.22 years ranging from 29 to 70 years. Most of the patients were male 42(84%). Majority of the patients had anterior wall (anterior, antero-septal & extensive anterior) myocardial infarction (54%). Sinus tachycardia in isolation was the most common arrhythmia observed in 36.8% of patients followed by sinus bradycardia (22.8%), ventricular tachycardia (19.3%), ventricular ectopic (12.3%), first degree AV block (5.3%), complete heart block and atrial ectopic 1.7% each. Tachyarrhythmias were more common in anterior wall myocardial infarction, whereas bradyarrhythmias were more common in inferior wall myocardial infarction. Among studied patients, 72% had favourable outcome, followed by acute left ventricular failure 10%, cardiogenic shock & lengthening of hospital stay 8% each and death 2%. **Conclusion:** The commonest arrhythmias encountered were sinus tachycardia followed by sinus bradycardia, ventricular tachycardia, ventricular ectopic, AV block and atrial ectopic. The incidence of mortality was 2%.

Keywords: Arrhythmia, Acute ST-segment elevated myocardial infarction, Outcome.

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Introduction:

Cardiovascular diseases (CVDs) are the leading causes of death globally. Despite decreasing mortality trends of coronary artery disease (CAD) in many developed countries, increasing number is noticed in developing countries.¹ Acute myocardial infarction (AMI) is myocardial necrosis in a clinical setting consistent with acute myocardial ischemia and detection of elevated values of cardiac biomarkers (troponin-I/ CK-MB) above the 99th centile of the upper reference limit.² A substantial number of patients with acute myocardial infarction have some cardiac rhythm abnormality and most cases cardiac conduction disturbance develop within 48 hours following infarct onset. Deaths most commonly occur within first few hours of acute myocardial infarctions. Early deaths

are not related to the severity of infarct but observations from monitoring unit suggest that the mechanism in most of the cases is arrhythmias and cardiac asystole. Almost any rhythm disturbance can be associated with acute myocardial infarction, including bradyarrhythmias, supraventricular tachyarrhythmias, ventricular arrhythmias and atrioventricular block.

It is known that myocardial infarction leads to severe metabolic and electrophysiological changes that induce silent or symptomatic life-threatening arrhythmias. The most important assumption for key mechanism of arrhythmia in acute phase of coronary occlusion is microreentry due to inhomogeneity of electrical characteristics of ischemic myocardium. Cells of center of the ischemic zone have a relatively consistent increase in

extracellular potassium concentration. Whereas, cells in the border zone between ischemic region and normal myocardium are only partially depolarized and consequently have action potentials with larger amplitude. Slowing of impulse conduction take place in noticeably depressed areas leading to arrhythmias. The cellular electrophysiological method for reperfusion arrhythmias emerge to include washout of different ions such as lactate & potassium and toxic metabolic substance that have accumulated in ischemic zone.³ Peri-infarction arrhythmias are related with in-and out-hospital outcome of the patients, there is no available data of arrhythmias in AMI patients of Bangladesh. This study was to document the pattern of arrhythmias in acute ST elevated MI within 48 hours of hospitalization and their in-hospital outcome among the population of Bangladesh.

Methods:

This observational study was conducted in Cardiology Department of BSMMU during July, to December, 2018. Patients who admitted with acute STEMI in department of cardiology, BSMMU were initially approached and included in this study considering the inclusion and exclusion criteria. A total of 50 patients were included in the study. Before inclusion of the patient, purpose and procedure of the study was discussed with the patients and informed written consent was taken from those who agreed to participate in the study.

Inclusion Criteria:

1. Patients 18 years of age or above.
2. Patients with acute STEMI.
3. Patient who has given informed written consent.

Exclusion Criteria:

1. Patients less than 18 years of age.
2. NSTEMI.
3. Patients with documented arrhythmia before the episode of acute MI.
4. Patients with previous history of MI.
5. Patients with structural and valvular heart disease.

A detailed history with particular emphasis on the risk factors were noted and general physical along with thorough systemic examination was done. The patients were observed for the first 48 hours of hospitalization for detection of arrhythmia with baseline ECG at admission and continuous cardiac monitoring in the CCU. The pattern of the arrhythmias during this period & their in-hospital outcome were recorded in predesigned structured data collection sheet. After editing data analysis was carried out by using the Statistical Package for Social Science (SPSS) version 20.0 windows software. Continuous data were expressed as mean \pm SD. Categorical data were expressed as frequency and percentages. Categorical data were analyzed by Chi-Square test. P value of less than 0.05 was considered significant. The study was performed according to the guidelines of the Helsinki Declaration and was approved by the University ethical committee

Results:

A total of 50 patients were studied. Maximum number of patients were from age group 51 to 60 years (38%). The mean age was 53.38 ± 10.22 years ranging from 29 to 70 years. Most of the patients were male 42(84%). All of the female were house wife. Highest number of patients were businessman 15(30%) (Table 1).

76% of the patients had history of smoking followed by hypertension 64%, DM 40%, dyslipidemia 38%, overweight 34% and family history of CAD 18% (Table 2).

Table-I
Socio-demographic variables

Socio-Demographic Variables	Frequency	Percentage (%)
Age Groups	< 40 Years	06
	41 – 50 Years	13
	51 – 60 Years	19
	> 60 Years	12
Sex	Male	42
	Female	08
Occupation	Businessman	15
	House Wife	08
	Service Holder	05
	Retired	09
	Others	13
Total	50	100.0

Table-II
Distribution of risk factors

Risk Factors		Frequency	Percentage (%)
BMI Status	Normal Weight	26	52.0
	Under Weight	02	4.0
	Over Weight	17	34.0
	Obese	05	10.0
Family H/o CAD	Present	09	18.0
	Absent	41	82.0
Diabetes Mellitus	Diabetic	20	40.0
	Non Diabetic	30	60.0
Hypertension	Hypertensive	32	64.0
	Non Hypertensive	18	36.0
Smoking Status	Smoker	38	76.0
	Non Smoker	12	24.0
Dyslipidaemia	Present	19	38.0
	Absent	31	62.0
Total		50	100.0

46% of the patients had inferior MI followed by anterior MI 36%, antero-septal MI 16% and extensive anterior MI 2% (Table 3).

Among the 50 patients 44 patients had developed single arrhythmia, 5 developed double arrhythmias and one patient developed triple arrhythmias in the first 48 hours of hospitalization. Sinus tachycardia in isolation was the most common arrhythmia observed in 36.8% of patients followed by sinus bradycardia 22.8%, ventricular tachycardia 19.3%, ventricular ectopic 12.3%, first degree AV block 5.3%, complete heart block and atrial ectopic 1.7% each. Overall tachyarrhythmias (sinus & ventricular tachycardia) occurred in 56.1% patients and bradyarrhythmias (sinus bradycardia & complete heart block) in 24.5%. Overall incidence of ventricular arrhythmias (ventricular tachycardia & ventricular ectopic) was 31.6% & AV blocks (first degree & complete heart block) was 7% (Table 4).

Majority of arrhythmias (71.9%) occurred <12 hours of hospitalization. Progressively arrhythmia occurrence decreased with time (Table 5).

72% patients had favorable outcome, followed by acute left ventricular failure 10%, cardiogenic shock & lengthening of hospital stay 8% each and death 2% (Table 6).

Tachyarrhythmias (sinus & ventricular tachycardia) were more common in anterior wall (anterior, antero-septal & extensive anterior) myocardial infarction, whereas

bradyarrhythmias (sinus bradycardia & AV block) were more common in inferior wall myocardial infarction. This association between anatomical site of myocardial infarction and types of cardiac arrhythmias is statistically very highly significant ($P=0.000$) (Table 7).

Table-III
Distribution of anatomical sites of MI

Site of MI	Frequency	Percentage (%)
Inferior	23	46.0
Anterior	18	36.0
Antero-septal	08	16.0
Extensive Anterior	01	2.0
Total	50	100.0

Table-IV
Different types of arrhythmias documented in study subjects (n=57)

Cardiac Arrhythmia	Frequency	Percentage (%)
Sinus Tachycardia	21	36.8
Sinus Bradycardia	13	22.8
Ventricular Tachycardia	11	19.3
Ventricular Ectopic	07	12.3
First Degree AV Block	03	5.3
Complete Heart Block	01	1.7
Atrial Ectopic	01	1.7
Total	57	100.0

Table-V*Time of appearance of individual arrhythmias after hospitalization(n=57)*

Time of Appearance of Cardiac Arrhythmia	Frequency	Percentage (%)
< 12 Hours	41	71.9
12 – 24 Hours	09	15.8
24 – 48 Hours	07	12.3
Total	57	100.0

Table-VI*In-hospital outcomes*

Outcome	Frequency	Percentage (%)
Death	01	2.0
Cardiogenic Shock	04	8.0
Acute Left Ventricular Failure	05	10.0
Lengthening of Hospital Stay	04	8.0
Favorable Outcome	36	72.0
Total	50	100.0

Table-VII*Association between anatomical sites of myocardial infarction and types of cardiac arrhythmias (n = 49)*

	Cardiac Arrhythmia		Total
	Tachyarrhythmia	Bradyarrhythmia	
Anterior	23	01	24
Inferior	09	16	25
Total	32	17	49

Chi-square (X^2) = 19.348; P = 0.000 (Very Highly Significant)**Discussion:**

The age distribution in this present study ranged from 29 to 70 years with maximum number of patients in the age group 51 to 60 years. This is comparable with findings of Patil et al.,⁴ who found the maximum number of patients in this similar age group. The mean age in this present study was 53.38 ± 10.22 years, which is comparable with the studies of Patil, B.M.,⁵ & Chowdhury et al.,⁶ who found mean age of the patients 53.61 ± 12.43 years & 53 ± 10 years respectively.

Among the study subjects 42 (84%) were male and 8 (16%) were female. Similar male preponderance was found in almost all studies on arrhythmia in AMI. Patil et al.,⁴ observed 77.50% male compared to 22.50% female & Rajhans et al.,⁷ observed 70% male compared to 30% female. As females are given less attention and access to the health care facilities is limited particularly in low

socioeconomic population like our country may contribute to this male predominance.

Risk factors analysis revealed that 76% of the patients had history of smoking. This is comparable with study of Patil, B.M.,⁵ who observed 70% of cases were smoker. Hypertension (64%) was the second commonest risk factor after smoking. Other risk factors include DM (40%), dyslipidemia (38%), overweight (34%) and family history of CAD (18%). According to Rajhans et al.,⁷ incidence of hypertension and diabetes were 66% and 54% respectively, which is very close to findings of this study. Patil, B.M.,⁵ found 36% of cases were dyslipidaemic, which is comparable with the present study.

In this study, majority of the patients had anterior wall (anterior, antero-septal & extensive anterior) myocardial infarction (54%). This is comparable with the study of Rajhans et al.,⁷ where overall incidence of anterior wall was higher (56%) than inferior wall which was 44%. Similarly according to Mhatre et al.⁸ incidence of anterior wall myocardial infarction (58%).

In this study sinus tachycardia was the most common arrhythmia observed in 36.8% cases. According to the study by Patil, B.M.,⁵ commonest arrhythmia was sinus tachycardia (40%), which is comparable with the current study. In other studies by Maturaju, N. & Chandrashekar, H.M.,⁹ and Sinha et al.,¹⁰ found sinus tachycardia were the commonest arrhythmias seen in 30% & 31% cases respectively. In the current study the second commonest arrhythmia was sinus bradycardia 22.8%, which is comparable with other studies by Nagabhushana et al.,¹¹ and Rathod et al.,¹² who found sinus bradycardia 22% & 19% respectively. Ventricular tachycardia was 19.3%, which is comparable with other studies of Maturaju, N. & Chandrashekar, H.M.,⁹ and Sinha et al.,¹⁰ who found ventricular tachycardia 20% & 25% respectively. In this study ventricular ectopic was 12.3%. This is in conformity with study by Chiwhane et al.,¹³ who found ventricular ectopic in 17% patients. In this study overall incidence of AV blocks was 7%, compared to other studies like Marangmei et al.,¹⁴ who found AV blocks almost double i.e. 15%. This disparity in incidence may be attributed to the small sample size in the current study. In the present study first degree AV block was 5.3%. This is comparable to study by Rathod et al.,¹² and Nagabhushana et al.,¹¹ who observed first degree AV block 4% & 3% respectively.

In this study majority of arrhythmias (71.9%) occurred within 12 hours of hospitalization. Similar findings were also observed by Patil, B.M.,⁵ where majority of arrhythmias occurred within 12 hours of hospitalization.

In the current study 87.7% arrhythmias occurred within 24 hours of hospitalization. This is in conformity with study by Patil et al.,⁴ where majority of arrhythmias (90%) occurred during the first 24 hours hospitalization.

72% of patients had favorable outcome, Similar outcome was found in almost all studies on arrhythmia in AMI. In the present study 10% patients developed acute left ventricular failure and 8% cardiogenic shock which are comparable with study of Sinha et al.,¹⁰ who found acute left ventricular failure and cardiogenic shock in 17% & 11% patients respectively. This slight disparity in incidence can be attributed to the small sample size in the present study. Tendency to go in shock was more common in CHB and VT, which is also well supported by study of Sinha et al.,¹⁰.

In this study there was one death (2%) that occurred in a patient with anterior MI who developed VT within 12 hours of hospitalization. According to the study of Patil, B.M.,⁵ the overall incidence of mortality was 15%, where majority of mortality occurred within 24 hours of hospitalization & most of the deaths occurred in VT & CHB. Advanced quality of CCU & ICU management of STEMI in University Cardiac Center, BSMMU and small sample size may have contributed to lower in-hospital mortality in this study.

In the current study tachyarrhythmias (sinus tachycardia and ventricular tachycardia) were more common in anterior wall (anterior, antero-septal & extensive anterior) myocardial infarction, whereas bradyarrhythmias (sinus bradycardia & AV block) were more common in inferior wall myocardial infarction. This association between anatomical site of myocardial infarction and types of cardiac arrhythmias is statistically very highly significant ($p=0.000$). Similar association between anatomical site of myocardial infarction and types of cardiac arrhythmias were observed by Rathod et al.,¹² and Marangmei et al.¹⁴

Though the findings in this study are mostly in agreement with previous studies on arrhythmias in acute STEMI, some findings were insignificant or inconsistent. This may be due to the following limitations:

- Single center study.
- Result of the study might be influenced by relatively small sample size.
- Sampling method was purposive, so there was risk of selection bias.

Conclusion:

The commonest arrhythmias encountered were sinus tachycardia followed by sinus bradycardia, ventricular

tachycardia, ventricular ectopic, AV block and atrial ectopic. Most of arrhythmias developed within 12 hours of hospitalization. Tachyarrhythmias were more common in anterior wall myocardial infarction, whereas bradyarrhythmias were more common in inferior wall myocardial infarction. The incidence of mortality was 2%.

Conflict of interest:

Authors has no conflict of interest.

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