

## Observational Study of Arrhythmias in Patients with Acute ST Elevated Myocardial Infarction and their In-Hospital Outcome

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### Abstract:

**Background:** Arrhythmia is the most frequent factor in the post-infarction phase after acute myocardial infarction (AMI), which is a leading cause of death globally. Early acute MI arrhythmia detection and therapy are important for both short- and long-term outcomes. The study objective is to assess the distribution of arrhythmias in acute STEMI patients throughout the first 48 hours of hospitalization as well as their prognosis while still in the hospital.

**Methods:** In this study, inclusion and exclusion criteria led to the inclusion of 50 patients with acute STEMI in total. With a baseline ECG upon admission and ongoing cardiac monitoring in the CCU, the patients were monitored for the first 48 hours of their hospital stay to look for arrhythmias. In a predesigned structured data collecting sheet, the pattern of the arrhythmias throughout this time and their in-hospital outcome were documented.

**Result:** The age ranged from 29 to 70 years, with the mean being  $53.38 \pm 10.22$  years. 42 patients (84%) were mostly men. The majority of the patients (54%) had anterior wall myocardial infarction, including significant anterior, anterior, and antero-septal infarction. The most frequent arrhythmia seen in 36.8% of patients was sinus tachycardia alone, followed by sinus bradycardia (22.8%), ventricular tachycardia (19.3%), ventricular ectopic (12.3%), first degree AV block (5.3%), total heart block, and atrial ectopic 1.7% each. When a myocardial infarction affected the inferior wall as opposed to the anterior wall, tachyarrhythmias were more frequent. 72% of the patients in the study had favorable outcomes, with acute left ventricular failure coming in second with 10%, cardiogenic shock coming in third with 8%, and mortality coming in second with 2%.

**Conclusion:** Sinus tachycardia was the most frequent arrhythmia found, followed by sinus bradycardia, ventricular tachycardia, ventricular ectopic, AV block, and atrial ectopic. Mortality was 2% of the population.

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

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### Introduction

In the entire world, cardiovascular diseases (CVDs) are the main killers. Although coronary artery disease (CAD) death patterns are on the decline in many wealthy countries, developing countries are seeing an increase.[1]

Acute myocardial infarction (AMI) is the term used to describe myocardial necrosis in a clinical scenario compatible with acute myocardial ischemia and the discovery of increased cardiac biomarker readings (troponin-I/CK-MB) beyond the 99th percentile of the upper reference limit.[2]

Many patients with acute myocardial infarction have some type of cardiac rhythm abnormalities, and in the

majority of cases, cardiac conduction disturbance appears 48 hours after the infarct first appears. In the initial few hours after an acute myocardial infarction, deaths most frequently happen. Early deaths are not connected to the size of the infarct, although monitoring unit observations imply that arrhythmias and cardiac asystole are the common mechanism in most cases. Nearly any rhythm abnormality, such as bradyarrhythmias, supraventricular tachyarrhythmias, ventricular arrhythmias, and atrioventricular block, can be linked to acute myocardial infarction.

Myocardial infarction is known to cause serious electrophysiological and metabolic alterations that result

in silent or symptomatic life-threatening arrhythmias. The most significant hypothesis for the primary mechanism of arrhythmia in the acute period of coronary occlusion is microreentry caused by electrical inhomogeneity of the ischemic myocardium. Extracellular potassium concentration rises very steadily in the cells at the core of the ischemia zone. However, because they are only partially depolarized, the cells in the border region between the ischemia region and normal myocardium contain action potentials that are higher in amplitude.

Arrhythmias are caused by the slowing of impulse conduction in visibly depressed regions. Washout of various ions, such as lactate and potassium, and hazardous metabolic material that have accumulated in the ischemic zone are included in the cellular electrophysiological approach for reperfusion arrhythmias.[3]

In this study, the pattern of arrhythmias in acute ST raised MI within 48 hours of admission and their prognosis during hospitalization were to be documented.

#### Material and Methods

This observational study was conducted in Medicine Department of Govt. Medical College and Hospital, Bettiah, West Champaran, Bihar during October 2022 to March 2023. In this study inclusion and exclusion criteria were first applied to patients who were admitted with acute STEMI in the department of medicine at GMCH. The study consisted of 50 patients in total. Before a patient was included in the

study, the purpose and methodology were explained to them, and those who agreed to participate in the study provided signed informed consent. Patients under the age of 18, NSTEMI, documented arrhythmia prior to the occurrence of acute MI, prior MI history, and valvular heart disease were excluded from the study.

A full systemic examination was performed after taking a thorough systemic history with a focus on the risk factors. With a baseline ECG upon admission and ongoing cardiac monitoring in the CCU, the patients were monitored for the first 48 hours of their hospital stay to look for arrhythmias. In a pre-designed structured data collecting sheet, the pattern of the arrhythmias throughout this time and their in-hospital outcome were documented. The Statistical Package for Social Science (SPSS) version 20.0 Windows software was used to analyze the data after modification. Mean $\pm$  SD was used to express continuous data. Frequency and percentages were used to represent categorical data. The Chi-Square test was used to assess categorical data. P values < 0.05 were regarded as significant.

#### Results

50 patients in all were investigated. Most patients (38%) fell within the 51 to 60 year age range. The age ranged from 29 to 70 years, with the mean being 53.38 $\pm$ 10.22 years. 42 patients (84%) were mostly men. The women were all housewives. Businessmen made up the largest percentage of patients (15, 30%) (Table 1).

**Table 1: Demographic variables of included patients (n=50)**

| Variables         | No. of cases | Percentage (%) |
|-------------------|--------------|----------------|
| <b>Age group</b>  |              |                |
| • <40 years       | 06           | 12%            |
| • 41-50 years     | 13           | 26%            |
| • 51-60 years     | 19           | 38%            |
| • >60 years       | 12           | 24%            |
| <b>Sex</b>        |              |                |
| • Male            | 42           | 84%            |
| • Female          | 08           | 16%            |
| <b>Occupation</b> |              |                |
| • Businessman     | 15           | 30%            |
| • House wife      | 08           | 16%            |
| • Service holder  | 05           | 10%            |
| • Retired         | 09           | 18%            |
| • Others          | 13           | 26%            |

The majority of patients (76%), followed by hypertension (64%), diabetes (DM), dyslipidemia (38%), obesity (34%), and family history of coronary artery disease (18%), had a history of smoking.

**Table 2: Distribution of Risk factors (n=50)**

| Risk Factors                                   | No. of cases | Percentage (%) |
|--|--------------|----------------|
| <b>BMI Status</b>                              |              |                |
| • Normal weight                                | 26           | 52%            |
| • Under Weight                                 | 02           | 4%             |
| • Overweight                                   | 17           | 34%            |
| • Obese  | 05           | 10%            |
| <b>Family history of Cardio Artery Disease</b> |              |                |
| • Present                                      | 09           | 18%            |
| • Absent                                       | 41           | 82%            |
| <b>Diabetes Mellitus</b>                       |              |                |
| • Diabetic                                     | 20           | 40%            |
| • Non-diabetic                                 | 30           | 60%            |
| <b>Hypertension</b>                            |              |                |
| • Hypertensive                                 | 32           | 64%            |
| • Non-Hypertensive                             | 18           | 36%            |
| <b>Smoking Status</b>                          |              |                |
| • Smoker                                       | 38           | 76%            |
| • Non-Smoker                                   | 12           | 24%            |
| <b>Dyslipidemia</b>                            |              |                |
| • Present                                      | 19           | 38%            |
| • Absent                                       | 31           | 62%            |

Inferior MI was seen in 46% of the patients, anterior MI in 36%, antero-septal MI in 16%, and severe anterior MI in 2% (Table 3).

**Table 3: Distribution of anatomical sites of Myocardial Infarction (MI)**

| Site of MI         | No. of cases | Percentage (%) |
|--------------------|--------------|----------------|
| Inferior           | 23           | 46%            |
| Anterior           | 18           | 36%            |
| Anterior-septal    | 08           | 16%            |
| Extensive Anterior | 01           | 2%             |
| Total              | 50           | 100%           |

In the first 48 hours of hospitalization, 44 of the 50 patients experienced a single arrhythmia, 5 experienced double arrhythmias, and 1 experienced triple arrhythmias. The most frequent arrhythmia seen in 36.8% of patients was sinus tachycardia alone, followed by sinus bradycardia, ventricular tachycardia, ventricular ectopic, first-degree AV block, total heart

block, and atrial ectopic 1.7% each. In all, 56.1% of patients experienced sinus and ventricular tachycardia, and 24.5% experienced sinus bradycardia and full heart block. Incidence rates for AV blocks (first degree and complete heart blocks) were 7% and 31.6% for ventricular arrhythmias (ventricular tachycardia and ventricular ectopic) respectively (Table 4).

**Table 4: Different types of arrhythmias documented in study subjects (n=57)**

| Cardiac Arrhythmia      | No. of cases | 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%         |

The majority of arrhythmias (71.9%) happened within 12 hours after being hospitalized. Arrhythmias became less frequent with time (Table 5).

**Table 5: Time of appearance of individual arrhythmias after hospitalization (n=57)**

| Time of Appearance of Cardiac Arrhythmia | No. of cases | Percentage (%) |
|--|--------------|----------------|
| <12 hours                                | 41           | 71.9%          |
| 12-24 hours                              | 09           | 15.8%          |
| 24-48 hours                              | 07           | 12.3%          |
| Total                                    | 57           | 100.0%         |

Acute left ventricular failure (10%), cardiogenic shock, a longer hospital stay (8%) each, and death (2%) were the outcomes that were least desirable for 72% of the patients (Table 6).

**Table 6: Outcome**

| Outcome                        | No. of cases | Percentage (%) |
|--------------------------------|--------------|----------------|
| Death                          | 01           | 2%             |
| Cardiogenic Shock              | 04           | 8%             |
| Acute Left Ventricular Failure | 05           | 10%            |
| Lengthening of Hospital Stay   | 04           | 8%             |
| Favorable Outcome              | 36           | 72%            |
| Total                          | 50           | 100.0%         |

While sinus bradycardia and AV block were more frequent in inferior wall myocardial infarction, sinus tachycardia and ventricular tachycardia were more frequent in anterior wall (anterior, antero-septal, and extended anterior) myocardial infarction. It is statistically extremely highly significant ( $P=0.000$ ) (Table 7) that there is a correlation between the anatomical site of myocardial infarction and the different forms of cardiac arrhythmias.

**Table 7: 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 study spanned from 29 to 70 years, with the age range of 51 to 60 years having the highest proportion of patients. This is comparable to the research done by Patil et al.[4], who discovered the greatest number of patients in this same age group. The mean age in the current study was  $53.38 \pm 10.22$  years, which is comparable to the mean ages of the patients in Patil, B.M.,[5], and Chowdhury et al.,[6], whose studies reported mean ages of  $53.61 \pm 12.43$  years and  $53 \pm 10$  years, respectively.

42 (84%) of the study participants were men, while 8 (16%) were female. Almost all research on arrhythmia in AMI revealed a similar male preponderance. In both Patil et al.,[4] and Rajhans et al.,[7] observations, there were more men than women (77.50% male to 22.50% female). This male predominance may be caused by the fact that female receive less attention and have less access to medical facilities, especially in countries with poor socioeconomic populations like our own.

Analysis of the risk factors showed that 76% of the patients had smoked previously. This is similar to a research by Patil, B.M.,[5], which found that 70% of cases involved smokers.

After smoking, hypertension (64%) was the second most prevalent risk factor. DM (40%), dyslipidemia (38%), being overweight (34%) and having a family history of CAD (18%) are additional risk factors. Rajhans et al [7] estimate of the prevalence of diabetes and hypertension was 54% and 66%, respectively, which is quite similar to the results of this study.

According to Patil, B.M.,[5] 36% of cases were dyslipidemic, which is similar to the findings of the current investigation.

In this study, the majority of patients (54%) experienced anterior wall myocardial infarction, including extensive anterior, anterior, and antero-septal infarction. This is analogous to Rajhans et al. study [7], where the incidence of the anterior wall overall was greater (56%) than the incidence of the inferior wall, which was 44%.

In a similar vein, Mhatre et al.[8] reported a 58% incidence of anterior wall myocardial infarction.

Sinus tachycardia was the most prevalent arrhythmia seen in 36.8% of patients in this study. The most prevalent arrhythmia, according to the Patil, B.M.,[5] study, was sinus tachycardia (40%), which is comparable to the results of the current investigation. In previous investigations, sinus tachycardia was discovered to be the most prevalent arrhythmia in 30% and 31% of cases, respectively, by Maturaju, N. & Chandrashekhar, H.M.,[9] and Sinha et al.,[10]. Sinus bradycardia, which was the second most prevalent arrhythmia in the current study, was observed in 22.8% of participants. This is comparable to the results of investigations by Nagabhushana et al.[11] and Rathod et al.[12], which reported sinus bradycardia in 22% and 19% of participants, respectively. In earlier investigations by Maturaju, N. & Chandrashekhar, H.M.,[9] and Sinha et al.,[10] who discovered ventricular tachycardia 20% & 25% respectively, ventricular tachycardia was found to be 19.3%, which is comparable. Ventricular ectopic rate in this study was 12.3%. This is consistent with a research by Chiwhane et al.[13], which discovered that 17% of individuals had ventricular ectopics. When compared to other studies like Marangmei et al.[14], who reported AV blockages almost double, at 15%, this study's total incidence of AV blocks was 7%. The small sample size in the current study may be to blame for this variation in occurrence. The first-degree AV block in the current investigation was 5.3%. In studies by Rathod et al.[12] and Nagabhushana et al.[11], first degree AV block was found to be 4% and 3%, respectively.

The majority of arrhythmias (71.9%) in this study happened within a day of hospitalization. Similar results were noted by Patil, B.M.[5], who found that the majority of arrhythmias happened within 12 hours of hospitalization.

Within 24 hours of hospitalization, 87.7% of arrhythmias occurred in the current study. According to a study by Patil et al.[4] the majority of arrhythmias (90%) occurred during the first 24 hours of hospitalization, this is in line with his findings.

Almost all investigations investigating arrhythmia in AMI reported a similar outcome, with 72% of patients having a positive outcome. In the current study, 10% of patients experienced acute left ventricular failure, and 8% went into cardiogenic shock, which is close to Sinha et al. study [10], which reported that 17% and 11% of patients, respectively, experienced acute left ventricular failure and cardiogenic shock. The present study's small sample size can be blamed for the little difference in occurrence. The study by

Sinha et al.,[10] provides additional evidence that the CHB and VT populations had a higher tendency to experience shock.

One patient with anterior MI who developed VT within 12 hours of admission died in this trial (2% fatality rate). According to the Patil, B.M.,[5] study, the total incidence of mortality was 15%, with the majority of deaths occurring within 24 hours of admission and the majority of deaths taking place in VT and CHB.

In the present study, sinus bradycardia and AV block were more frequent in inferior wall myocardial infarction while sinus bradycardia and ventricular tachycardia were more frequent in anterior wall (anterior, antero-septal, and extensive anterior) myocardial infarction. It is statistically extremely significant ( $p=0.000$ ) that there is a relationship between the anatomical site of myocardial infarction and the different forms of cardiac arrhythmias. Rathod et al.[12] and Marangmei et al.[14] found a similar correlation between the anatomical site of myocardial infarction and the types of cardiac arrhythmias.

## Conclusion

Sinus tachycardia was the most frequent arrhythmia found, followed by sinus bradycardia, ventricular tachycardia, ventricular ectopic, AV block, and atrial ectopic. Within 12 hours of being hospitalized, the majority of arrhythmias developed. Compared to inferior wall myocardial infarction, anterior wall myocardial infarction was associated with a higher prevalence of bradyarrhythmias. Mortality was 2% of the population.

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