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**Original Article**

# Evaluation of ventricular tachyarrhythmias in patients with myocardial infarction after streptokinase therapy

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## Abstract

**Objectives:** The occurrence of arrhythmias after myocardial infarction is associated with an increased risk of mortality. The purpose of this study was to investigate tachyarrhythmias after streptokinase therapy in myocardial infarction patients.

**Methods:** This study was a case-control study. Among 262 patients with myocardial infarction who received streptokinase, 168 patients with ventricular tachyarrhythmia, ventricular fibrillation, or both (case group), and 94 patients without arrhythmia (control group) were selected. Their clinical information were collected by questionnaire. Data were analyzed using SPSS 20 software through chi-square test and Wilcoxon rank-sum.

**Results:** There was no relationship between demographic variables or electrocardiogram changes and the type of arrhythmia in 168 participants in the group 1 ($p > 0.05$). However, there was a significant relationship between age ($p = 0.04$), sex ($p = 0.049$), diabetes ($p = 0.039$), hypertension ($p = 0.037$), history of beta-blocker use ($p = 0.028$), history of aspirin use ($p = 0.023$), number of the leads involved ($p = 0.023$) and occurrence of arrhythmia among the participants in the group 2.

**Conclusions:** According to the findings of this study, patients with myocardial infarction who need to receive thrombolysis and who have any of the following conditions should be monitored by the health care staff to prevent development of ventricular tachyarrhythmias: old age, male gender, history of diabetes mellitus, hypertension or more lead involvement in their electrocardiogram.

**Keywords**: Cardiac arrhythmia; Electrocardiography; Myocardial infarction; Streptokinase therapy

## Introduction

Even though the rate of mortality caused by coronary heart disease (CAD) has been decreased over the past few decades, coronary heart disease is still the primary cause of death in most developing countries (1). These disease types have a high mortality rate and some side effects, including physical, psychological, and social problems for the patients (2). CAD has spread from the Western world to the developing countries and has destructive effects on human resources (3). However, during the past 25 years, there has been a significant reduction in the

mortality rate associated with CAD in industrialized and developed countries. The primary cause of this decrease is the identification of risk factors affecting CAD (4).

In Iran, it is reported that 38% of the deaths are due to the coronary artery disease (5). Myocardial Infarction (MI) is usually caused by acute obstruction of a coronary artery and sudden blockage of blood flow and oxygen supply to the heart muscle (6).

Given that a high percentage of these patients (according to some studies ,up to 10.3% of cases) experience one type of ventricular tachyarrhythmias such as ventricular tachycardia (VT) and ventricular fibrillation (VF); consequently, these arrhythmias are the leading causes of death following MI (7). Thus, diagnosis and evaluation of arrhythmias, risk factors ,and prompt treatment are of great importance (8).

The use of thrombolytic agents by the clot lysis and reperfusion prevents irreversible myocardial changes by 33 percent (9). Infarct reperfusion is usually accompanied by transient arrhythmias such as multiple premature ventricular contractions and idioventricular rhythm (10-13)

The causes of arrhythmias, including ventricular tachyarrhythmias, have been studied in a limited number of studies so far. Electrocardiographic criteria as simple and inexpensive methods can be helpful in finding a meaningful relationship both before and after streptokinase. In addition, given that a large percentage of patients with myocardial infarction receive thrombolytic drugs, such as streptokinase, and may develop ventricular tachyarrhythmias following streptokinase, these arrhythmias largely affect the patients' survival rates.

The prevalence of ventricular arrhythmias in the GUSTO-I study was about 10.2 percent, 3.5% of arrhythmias were VT alone, 4.1% of arrhythmias were VF alone, and 2.7% of arrhythmias were VF and VT.

In one study, reperfusion arrhythmias occurred in 20 out of 27 patients with acute myocardial infarction (74%) (14). In another study, 49% of patients developed arrhythmia due to reperfusion (15).

The main issue found in various studies is that there is a significant relationship between the occurrences of these arrhythmias and the poor prognosis of patients. Therefore, it is important to identify the contributing and risk factors in arrhythmias. Moreover, a question arises regarding the fact that which group is more likely to develop arrhythmias. Another question directs the possibility of assessing the risk of arrhythmias in patients with myocardial infarction before its occurrence.

Little studies have investigated these problems in Iran. This study aimed to assess ventricular tachyarrhythmias after streptokinase therapy in the patients with acute myocardial infarction.

## Materials and Methods

The present study was a cross-sectional study and was conducted in Shahid Madani Educational and Medical Center in Tabriz, Iran. From among 262 patients presented with a diagnosis of myocardial infarction from April 2005 to December 2012 and received streptokinase, 168 patients who developed ventricular arrhythmias after receiving streptokinase,were selected as (Group 1) and 94 patients who have not had ventricular tachyarrhythmia following streptokinase were randomly assigned to (Group 2).

Inclusion criteria of the study were as followed: patients diagnosed with myocardial infarction treated with streptokinase followed by ventricular tachyarrhythmias (VF and VT or both) in the same hospital for the sample population (Group 1), and the patients with a diagnosis of myocardial infarction treated with streptokinase followed by no ventricular tachyarrhythmia in the same hospital for the control population (Group 2)

Exclusion criteria, including: the patients with SBP <80 and need inotropic drugs due to the arrhythmogenicity of these drugs, left bundle branch block (LBBB), pacemaker-dependent rhythm, Killip class III, IV, Contraindication for thrombolytic therapy.

The data collection tool was a questionnaire, including demographic characteristics, diabetes, history of cardiac drug use based on history and ECG changes, and type of arrhythmia (VF and VT or both) based on electrocardiogram tape entered into the patients' records. The collected data were imported into SPSS, version 21. Finally, descriptive methods, frequency of descriptive statistics and mean difference test for independent groups of quantitative variables and Chi-square test for qualitative variables and Wilcoxon rank-sum test was used to measure mean and standard deviation. $P< 0.05$ was considered significant.

The Ethics Committee of the University approved, the proposal, and then the questionnaires were completed with the coordination and consent of the hospital administrators. The Research and Ethics Committee of Tabriz University of Medical Sciences approved this study, based on the code of IR.TBZMED.REC.1390/1-10/15.

## Results

Among 262 patients with the diagnoses of MI, 168 patients with arrhythmia, and 94 patients without arrhythmia were selected and their information was collected. Descriptive statistics showed that out of 168 patients with arrhythmia, 105 (62.5%) were male, and 63 (37.5%) were female. Out of the 94 patients without arrhythmia, 47 (50%) were male and 47 (50%) were female. The mean age of the patients with arrhythmia was 65.58 11±11.38 years, and those without arrhythmia were 61.62 ±8.88 years. Detailed information regarding the demographic characteristics of the research is given in Table 1.

### *ECG results*

- In the patients with arrhythmia, the type of arrhythmia was VT in 81 patients (48.2%), VF in 66 patients (39.3%), and VT + VF in 21 patients (12.5%).
- The mean number of leads in patients was studied, so that in patients with arrhythmia, three leads in 18 patients (10.7%), four leads in 23 patients (13.7%), and five leads in 61 patients (36.3%), six leads in 32 patients (19.1%), seven leads in 15 patients (8.9%), as well as eight leads in 19 patients (11.3%), were observed (Table 2).

**Table 1.** Demographic characteristics of patients participating in the study

| Variable | | Patients with arrhythmias | Patients without arrhythmias |
|---|---|---|---|
| Gender | Male | 62.5% (105) | 50% (47) |
| | Female | 37.5% (63) | 50% (47) |
| Age | | 65.58±11.38 | 61.62 ± 8.88 |
| DM | | 35.7% (60) | 23.4% (22) |
| HLP | | 25% (42) | 19.1% (18) |
| HTN | | 56% (94) | 42.5% (40) |
| Smoking | | 42..3% (71) | 30.8% (29) |
| CABG | | 2.4% (4) | 2.12% (2) |
| MI | | 23.2% (39) | 11.7% |
| Beta-blocker | | 29.2% (49) | 42.5% (40) |
| ASA | | 19% (32) | 8.5% (8) |
| ACE | | 4.2% (7) | 6.3% (6) |
| ARBs | | 6.5% (11) | 6.3% (6) |
| CCBs | | 6% (10) | 6.3% (6) |
| EF mean | | 32.45 ±11.54 | 32.62 ± 10.70 |
| ST mean | | 5.76 ± 2.47 | 5.31± 1.82 |

DM: Diabetes Mellitus; HTN: Hypertension; HLP: Hyperlipidemia; CABG: Coronary artery bypass grafting; B blocker: Beta blockers; ACEi: ACE inhibitor; ARBs: Angiotensin II receptor blockers; CCBs: Calcium-Channel Blockers; ASA: Aspirin; EF: Ejection Fraction

**Table 2.** ECG findings of patients participating in the study

| ECG Lead | | Patients with arrhythmias % (N) | Patients without arrhythmias % (N) |
|---|---|---|---|
| Type of arrhythmias | VT | 48.2 (81) | 0 |
| | VF | 39.3(66) | 0 |
| | VT + VF | 12.5(21) | 0 |
| Number of involved leads | 3 Leads | 10.7 (8) | 12.7 (12) |
| | 4 Leads | 13.7 (23) | 22.3 (21) |
| | 5 Leads | 36.3 (61) | 40.44 (38) |
| | 6 Leads | 19.1 (32) | 11.7 (11) |
| | 7 Leads | 89 (15) | 7.4 (7) |
| | 8 Leads | 11.3 (19) | 5.3 (5) |

VT: Ventricular Tachycardia; VF: Ventricular Fibrillation

In the patients without arrhythmia, 3 leads in 12 patients (12.7%), 4 leads in 21 patients (22.3%), 5 leads in 38 patients (40.4%), 6 leads in 11 patients (7%) 11/7), 7 leads in 7 patients (7.4%) as well as 8 leads in 5 patients (5.3%) were recorded (Table 3). Based on the results of the type of leads involved and their analyses according to common anatomic positions (type of coronary arteries' involvement) in the patients with and without arrhythmia, the findings were as follows:

An investigation of the effect of demographic factors and ECG findings based on the comparison of two groups with or without arrhythmia:

Analysis and comparison of demographic variables and their relationship with arrhythmia showed that there was a significant relationship between arrhythmia and variables such as age (p= 0.04), gender (p= 0.049), diabetes (p=0.039), hypertension (p= 0.037), beta-blocker use (p= 0.028), aspirin use (p= 0.023), number of leads (p= 0.023); however, no relationship was found between arrhythmia and other variables (Table 4).

**Table 3.** Type of leads involved and their anatomic position in group 1 and group 2

| Localization | Leads | Frequency in arrhythmia | Percent in arrhythmia | Frequency in non-arrhythmia | Percent in non-arrhythmia |
|---|---|---|---|---|---|
| Inferior | II-III-AVF | 16 | 8.60% | 13 | 12.62% |
| Septal | V1-V2 | 1 | 0.53% | 0 | 0 |
| Anterior | V3-V4 | 1 | 0.53% | 1 | 0.97% |
| Anteroseptal | V1-V4 | 11 | 5.9% | 6 | 5.82% |
| Extensive anterior | V1-V6 | 75 | 40.32% | 34 | 33% |
| An.inf | II-III-AVF V1-V6 | 49 | 26.34% | 32 | 31.06% |
| Ant.lat | I-AVL V1-V6 | 31 | 16.67% | 15 | 14.56% |
| Posterior | V4R | 1 | 0.53% | 0 | 0 |
| Lateral | I-AVL V5&V6 | 1 | 0.53% | 2 | 1.94% |

**Table 4.** An investigation of the relationship between demographic variables and ECG of group 1 and group 2

| Variables | | Arrhythmic | Non-arrhythmic | P value | Odds ratio |
|---|---|---|---|---|---|
| Age | | 65.58 ±11.38 | 61.62 ± 8.88 | 0.04 | - |
| Gender | Male | 62.5% | 50% | 0.049 | 1.66 |
| | Female | 37.5% | 50% | | |
| DM | | 35.71% | 23.40% | 0.39 | 1.88 |
| HTN | | 55.9% | 42.5% | 0.037 | 1.71 |
| HLP | | 25% | 19.1% | 0.28 | 1.40 |
| Smoking | | 42.2% | 31.8% | 0.06 | 1.64 |
| CABG | | 2.38% | 1.19% | 0.895 | 1.12 |
| Re-MI | | 23.3% | 11.7% | 0.055 | 2.28 |
| B-blocker | | 29.1% | 42.5% | 0.028 | 0.55 |
| ACEi | | 4.1% | 6.3% | 0.42 | 0.63 |
| ARBs | | 65.54% | 6.3% | 0.95 | 1.02 |
| CCBs | | 5.9% | 6.3% | 0.88 | 0.92 |
| ASA | | 19.04% | 8.51% | 0.023 | 2.52 |
| EF | | 32.45 ±11.54 | 32.62 ± 10.70 | 0.92 | - |
| Ant. MI | | 40.32% | 33% | 0.04 | 1.44 |
| Inf. MI | | 8.60% | 12.62% | 0.06 | 0.64 |
| Ant.lat MI | | 16.67% | 14.56% | 0.1 | 1.02 |
| Ant.inf MI | | 26.34% | 31.06% | 0.06 | 1.12 |
| ST Elev. | | 2.47 ± 5.76 | 2.81 ± 5.31 | 0.12 | - |
| No. of .inv.Leads | | 1.42 ± 5.35 | 1.28 ± 4.95 | 0.023 | - |
| ST res. At90 min | | 32.14% | 36.17% | 0.50 | 0.83 |
| Cum.ST Elev. | | 8.05 ± 18.99 | 6.94 ± 18.64 | 0.99 | - |

DM: Diabetes Mellitus; HTN: Hypertension; HLP: Hyperlipidemia; CABG: Coronary artery bypass grafting; MI: Myocardial Infarction, B blocker: Beta blockers; ACEi: ACE inhibitor; ARBs: Angiotensin II receptor blockers; CCBs: Calcium-Channel Blockers; ASA: Aspirin, EF: Ejection Fraction

## Discussion

This study illustrated that in the patients with MI, variables such as age, sex, history of diabetes, hypertension, history of beta-blocker use, history of aspirin use, and the number of leads with ST-elevation were associated with the development of arrhythmia.

In our study, there was a significant relationship between age and arrhythmia. This finding is consistent with the results of the previous studies. In 2008, Koeth et al. reported that mortality over age

80 was associated with a higher incidence of MI arrhythmias (16). In another study, age was also associated with arrhythmia and the mean age was higher in the group with arrhythmia (17).

In evaluating the role of gender, our study showed that males were more susceptible to arrhythmias after thrombolytic therapy; thus, this requires more attention in predicting arrhythmias in males. Koeth et al. reported that generally, being female, ages above 80, anterior location of MI, and a history of past coronary heart disease are among the contributing factors to increased mortality (16).

There is minimal evidence on the relationship between electrocardiographic features during admission and arrhythmias after thrombolytic therapy. Scrutinizing ST factor in the ECG of the patients with and without arrhythmia during entry revealed that there was no significant relationship between sum of ST- elevation and the development of arrhythmia (15).

However, no studies have been conducted in this area, and only the relationship between the anatomical position of the infarct and the arrhythmia has been investigated. Analysis showed a statistically significant relationship between the number of leads with ST- elevation and the arrhythmia after thrombolytic therapy. This has not been investigated in the previous studies. Leotta et al. noted that increased QT interval increases the risk of arrhythmia and sudden death in diabetic and elderly patients after myocardial infarction (15).

Our study, showed a lack of clear association of a particular anatomic position with the development of arrhythmia. The findings of our study present the fact that the high correlation of anterior infarction with arrhythmia is simply due to its high prevalence.

An eleven-year prospective research carried out by Engstrom et al. showed that ventricular arrhythmias in the patients with a history of cardiovascular disease who had a risk factor for diabetes and smoking were significantly higher than other cardiac patients (18).

In contrast, in the present study, the statistical analysis of smoking factors between the two groups with and without arrhythmia showed no significant relationship between the history of smoking and arrhythmia development; however, the achieved P-value was a borderline. Previous studies also confirm the validity of this issue.

Our study found a significant relationship between diabetes mellitus and hypertension and the onset of arrhythmia. Therefore, in addition to maintaining its role as a risk factor for MI, diabetes mellitus and hypertension may also be risk factors for arrhythmias after thrombolytic therapy. In the study, no statistical relationship was found between hyperlipidemia and arrhythmia.

Our study showed that there was no strong relationship between the previous history of MI and arrhythmia. Previous studies showed myocardial infarction, extensive infarction (by enzymatic method), involvement of the left anterior descending coronary artery, and coronary artery occlusion ,and long-term infarct artery occlusion have a, direct association with reduced ventricular outflow rate and mortality; although, they did not indicate whether arrhythmias are associated with a history of previous MI or not (19).

In our study, drug history was also studied in the patients with and without arrhythmia, which showed a significant relationship between a history of beta-blocker and aspirin use with arrhythmias. This study suggests that beta-blockers may have a protective role in arrhythmia, but aspirin use is closely linked to arrhythmias. History of previous use of Angiotensin convertase enzyme, Angiotensin receptor blocker, and Calcium channel blocker did not show a significant relationship with arrhythmia after thrombolysis. In a study carried out by Buxton et al., the impact of a history of β-blocker medication use was evaluated. Although β-blocker drugs were predicted to be arrhythmia prophylaxis, the history of beta-blocker use increased the risk of arrhythmia. All in all, their research has shown that clinical factors, including drug history, have limited capability to accurately predict arrhythmias, which contradicts with the findings of this study and requires more extensive studies on the type of drug, dose ,and duration of administration with MI and arrhythmia (20).

The association of hypomagnesemia and the occurrence of ventricular arrhythmias has been studied in several studies, including Kafka (2.4 /0 0.3 mg / dl) (21), Baset (1.9 /0 0.3 mg / dl) (22) Higham (23), and Hekmat (12). The results of these studies showed that there had been a clear link between hypomagnesemia and the occurrence of ventricular arrhythmias following acute myocardial infarction. Since there have been reports of sudden death correlated with the number of minerals present in water (24), it is likely that patients living in low-magnesium geographic areas have lower magnesium levels after acute myocardial infarction. They are prone to the occurrence of ischemic heart disease, ventricular arrhythmias ,and sudden death (21, 25).

In several studies, atrial fibrillation has been associated with increased odds of left ventricular dysfunction and extent of necrosis. The prevalence of mortality with age and during anterior stroke has been reported in various studies. The frequency of higher grade clip mortality with or without significant risk factors has been reported (26). The role of risk factors in mortality is partially identified.

In some studies, magnesium has been considered a safe and relatively effective method to reduce the incidence of tachyarrhythmias and the risk of mortality following acute myocardial infarction (27). There are some limitations in this study:
The current study was cross-sectional and was conducted in a very limited period of time, the results of which may vary over time. The results of this study are also limited to patients admitted to Tabriz Shahid Madani Hospital, and the results may not be generalized to the patients in other cities.

## Conclusion

Based on the results of the present study, the patients who refer to hospitals with the following characteristics and complications: a myocardial infarction candidating for thrombolytic therapy, older age, male sex, a history of hypertension or diabetes mellitus,a history of previous aspirin consumption, high number of involved leads in ECG, should be well monitored by physicians and nurses to prevent the development of arrhythmias, primarily ventricular tachyarrhythmias.

## Conflicts of Interest

We declare that we have no conflict of interest about regard to the legal rights of this work.

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