

MEAN DURATION OF EKG CHANGES IN PATIENTS WITH UNSTABLE ANGINA

J Najafian MD, R Kelishadi MD, N Sarraf-Zadegan MD, M. Boshtam, A Emami, R Sharif Rohani

Abstract

INTRODUCTION: Chest pain in unstable angina is associated with EKG changes in T-wave and ST-segment, which may help diagnose the disease. Based on certain references EKG changes prolonged for more than 12 hours may be suggestive of non-Q myocardial infarction. This study was conducted to assess the mean duration of EKG changes in patients with unstable angina.

METHODS: This cross-sectional study was conducted on 34 patients in 2001. The subjects were randomly selected among patients hospitalized in the critical care unit of Isfahan Nour Hospital. New ST-segment T-wave changes and ruling out of acute myocardial infarction by enzymatic tests (Total CPK, CPK-MB, LDH) constituted criteria of inclusion in the study. Subjects with Wolf-Parkinson-White syndrome (WFW), salivary diseases, those taking anti-arrhythmic, anti-angina, or digital medications, patients with left bundle branch block, and those who had recently undergone surgery (all of which may cause T-wave and ST-segment changes) were excluded from the study. The patients were followed up for three months after discharges.

RESULTS: EKG changes persisted for 28.65 ± 7 days. Changes of ST-segment and T-wave lasted for 14.7 ± 24 and 30.1 ± 38 days, respectively. The minimum and maximum durations of EKG changes in patients were 1 day and 90 days, respectively. Eight patients underwent angiography; seven displayed abnormal findings. Statistical analysis did not show a significant relationship between the duration of EKG changes and severity of coronary involvement or incidence of future complications.

DISCUSSION: EKG changes in patients with unstable angina who have recently developed these changes may persist for an average duration of one month and may complicate diagnosis. Hence greater importance should be attached to clinical symptoms and further laboratory diagnostic methods should be used.

Keywords • Myocardial infarction • ST-segment • T-wave • EKG changes

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Introduction

Coronary Artery Diseases (CAD) include a wide array of conditions, ranging from asymptomatic ischemia to unstable angina and myocardial infarction (MI). Patients with history positive for at least one of the following have unstable angina:¹

- 1- Progressive angina pains (having greater intensity and longer duration, increased frequency of pain).
- 2- New angina (having first occurred within the last one month) developing with slight activity.
- 3- Resting angina, angina developing with little activity.^{1,3,4}

Patients usually display EKG changes during episodes of angina, however, these changes do not constitute diagnostic criteria and may even be absent in unstable angina.^{1,3-5} EKG changes are most typically seen in T-wave and ST-segment and often return to normal within 6 to 12 hours of pain management.¹ Persistence of ST-segment and T-wave changes for

corresponding author

Roya Kelishadi, Associate Professor, Preventive Pediatric Cardiology Department, Isfahan Cardiovascular Research Center, PO Box: 81465-1148
Email: kelishadi@med.mui.ac.ir

12 hours is usually suggestive of the probability non-Q-wave MI.¹

Increased level of cardiac enzymes is sometimes the only distinction between non-Q-wave MI and unstable angina, since EKG changes are at times highly similar. Holter monitoring has shown that ST-segment depression in 6% of unstable angina patients occurs episodically with no symptoms, which suggests silent ischemia.⁵

Abnormal ST-segment and T-wave changes are also common in healthy individuals. In the Framingham study these changes were reported at 8.5% in men and 7.7% in women.⁶

The prevalence of these changes increases with age and is higher in hypertensive, diabetic, and non-smoking individuals. Besides myocardial ischemia, a number of other factors can also cause ST-segment and T-wave changes. These include ventricular hypertrophy, ventricular dilatation, electrolyte imbalances, neurogenic stimulants, and anti-arrhythmic drugs.^{5,6} Cases of unstable angina in which EKG changes persisted days and weeks after the final episode of pain are by no means infrequent. Given the importance of the issue at hand and the obvious differences between various references in differentiating between these two groups of patients, and in view of the fact that EKG is widely used to detect different cardiac conditions, especially coronary artery diseases, this study was conducted with an emphasis on the mean duration of EKG changes in patients with unstable angina.

Materials and methods

This cross-sectional study was conducted in 2001 on 34 subjects who were randomly selected among patients with unstable angina hospitalized at the critical care unit of Isfahan Nour Hospital. Diagnostic criteria were as follows:

- a) History and clinical diagnosis of unstable angina based on standard criteria
- b) Unchanged levels of cardiac enzymes, i.e. CPK-MB, Total CPK, LDH)
- c) New EKG changes characteristic of unstable angina (ST-depression and inverted T-wave)

All of the 34 subjects under study were hospitalized due to cardiac pain and diagnosis of unstable angina. They included 18 men and 16 women. EKG changes were considered significant if they were absent from the patients' previous EKGs. Exclusion criteria were as follows:

ST-segment and T-wave changes similar to those seen in the patient's previous EKGs, consumption of digital drugs, tricyclic anti-depressants, antiarrhythmics, phenothiazines, left bundle branch

block, WPW syndrome, cardiomyopathy, new Q-wave in EKG suggestive of acute myocardial infarction, diseases of the salivary glands, prostate and uterus, increased levels of cardiac enzymes which may be due to non-Q-wave MI, and recent surgery.

Personal information questionnaires were completed for all patients upon hospitalization. All patients were followed for three months (i.e. weekly EKGs in the first months followed by monthly EKGs). CPK-MB and total CPK were measured upon entrance, as well as 12 and 24 hours later. LDH was measured on a daily basis between the second and fourth days of hospitalization. Blood samples were sent to the laboratory of Isfahan Cardiovascular Research Center and all of the tests were conducted by a trained technician, using German-made Merck test-kits.

CPK-MB increase greater than 6%, total CPK increase to values twice the normal level and LDH increase of greater than 500 units were considered as significant. Q-wave development accompanied by changes in enzyme levels was regarded as a sign of myocardial infarction and excluded the patient from the study. Data were analyzed by SPSS using descriptive statistical methods and statistical correlation test.

Results

The subjects had a mean age of 57.24±2 years, ranging from 34 to 75 years. All patients exhibited EKG changes, 15 had ST-segment depression and 28 had inverted T-wave.

ST-segment depression was down-sloping in 37.5% and slow-upward in the rest of patients with ST-segment depression. Mean duration of EKG changes in these patients was 28.65±7 days. Mean duration of ST-segment and T-wave changes was 14.7±24 and 30.1±38 days, respectively. Mean duration of EKG changes in patients with non-Q-wave MI approximated five weeks. EKG changes appeared as inverted T-wave and ST-segment depression for 4 and 1-3 days, respectively.

The patients remained hospitalized for a mean period of 3±0.15 days (minimum: 1 day, maximum: 5 days). EKG evaluation of patients with ST-segment depression showed ST-segment depression to be 3.12±0.22 mm in the first day and 1.9±0.4 mm in the second day; this downward trend continued in the following days. Among the subjects under study, only 8 underwent coronary angiography and 7 had abnormal angiograms. No significant relationship was found between the extent of coronary involvement and duration of ST-segment and T-wave changes. Correlation test did not show a significant relationship between the

duration of EKG changes in these patients and development of future complications (i.e. during the 3-month follow-up period). EKG was taken from patients after discharge from hospital and upon their visits to clinic. Table 1 shows the frequency of ST-segment and T-wave changes at different points in time.

TABLE 1. Frequency of ST-segment and T-wave changes at different times in patients with unstable angina.

Time	ST changes	T changes	Concomitant ST and T change
Day 1	44%	79%	27%
Day 2	32%	70%	24%
Day 3	29%	65%	21%
Day 4	26%	47%	15%
Week 1	20%	38%	12%
Month 1	14%	23%	9%
Month 3	5%	17%	3%

Discussion

Unstable angina is usually caused by rupture of an atherosclerotic plaque. This is followed by platelet aggregation at the site of injury and thrombus formation.^{5,8,9} This leads to a complete and transient, or partial and long-lasting obstruction, resulting in anginal pain. The former may be associated with ST elevation and the latter with ST depression.^{4,7,8} The presence of ischemic ST-T in EKG increases the specificity of diagnosis. However, 10% of individuals presenting with the above criteria and EKG changes have normal coronary angiograms.¹⁰⁻¹² From the clinical standpoint, ischemic ST and T changes in EKGs of patients with unstable angina are of higher prognostic value. These changes - whether primary or occurring during episodes of pain - have prognostic value. Patients with both ST-segment and T-wave changes stand a 42% chance of death within a year, nonetheless, those with normal EKG during episodes of pain have a 5% risk of death within two years.⁵ The presence of these changes usually suggests greater coronary involvement, wider ischemic region, and higher likelihood of poor collateral blood supply in the ischemic region, all of which contribute to poor patient prognosis.^{3,5}

ST-segment depression is the most common EKG finding in unstable angina (30% of cases).

T-wave inversion is the second most important EKG change. ST-segment elevation is only seen in 4% of subjects.¹⁰ ST-segment depression and T-wave inversion are suggestive of subendocardial ischemia

and ST-segment elevation suggests transmural ventricular ischemia.¹¹

Few studies have investigated the duration of ST-segment and T-wave changes after resolution of unstable angina pain. A period of 12 hours has been suggested by existing studies.¹ Other studies, however, have suggested that EKG changes persist longer after the resolution of pain. The duration found in this study was 28.65±days, which is significantly different from reference textbooks.

In many instances, unstable angina is mistaken for non-Q MI and increase in cardiac enzyme levels is the only clue to differential diagnosis.

The importance of differentiating between the two is better understood in light of the increase in hospitalization costs, modes of treatment, and post-discharge follow-up of MI patients. Many specific enzymes and markers are not measured in a large number of Iranian hospitals; hence the validity of this important differential diagnostic method has become questionable. Other factors, including precision of measurements and quality control of test-kits must also be taken into account. Moreover, given that physicians base their decisions regarding patient follow-up on existing references (i.e. possibility of non-Q MI provided EKG changes persist for 12 hours after resolution of pain), such studies become all the more important. Review of similar articles shows that non-Q-wave MI has often been diagnosed by measuring total CPK, CPK-MB and LDH. In this study, ST-segment and T-wave changes persisted for an average duration of 14.7±24 and 30.1±28 days, respectively. Prolonged ST-segment and T-wave changes in patients for whom non-Q-wave MI was earlier ruled out should prompt a re-examination of the possibility of non-Q-wave MI, since it has been shown that normal levels of the said enzymes do not provide adequate grounds for ruling out non-Q-wave MI. Measurement of troponin in patients with normal enzyme levels may provide a clue to the necrosis of cardiac tissue. As suggested in some textbooks, persistence of EKG changes during angina for 12 hours after pain management raises the possibility of non-Q-wave MI; however, it is not necessarily suggestive of myocardial infarction.

Although the possibility of some degree of myocardial necrosis should be considered in a number of patients with prolonged ST-segment and T-wave changes, the number of such patients remains below 5% of total in view of the high sensitivity of CPK-MB test.¹³ Prolonged EKG changes (up to 3 months) have also been reported in patients with unstable angina who underwent immediate treatment with angioplasty.¹⁴

In view of the results, it can be concluded that recent EKG changes in patients hospitalized due to unstable angina may last for an average period of one month. This should be born in mind in the patients' later visits and EKG evaluations, so that errors in diagnosis and unnecessary follow-ups could be minimized.

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