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Orjinal Araştırma / Original Article

Chest Pain and Single Troponin

Göğüs Ağrısı ve Tek Troponin

Süha Serin[1], Bahadır Çağlar[1]

[1]Balikesir University School of Medicine Department of Emergency Medicine, Balikesir, Turkey

Abstract

Aim: It is important to exclude the diagnosis of acute coronary syndrome quickly and accurately. This study aims to exclude the diagnosis of acute myocardial infarction (AMI) with a single troponin value in patients with appropriate clinical evaluation and electrocardiography (ECG)

Materials and Methods: Among the patients who were followed up with a pre-diagnosis of AMI and for whom a HEART score was calculated, patients whose high sensitive troponin I result was found below the limit of detection (LoD) value and who were discharged is included in study. All patients were contacted on the 30th day of discharge. The status of "major adverse cardiac events" (MACE-30) in the last 30 days was questioned.

Results: The HEART score of 122 patients (73.1%) in the study was found to be at low risk while 45 (26.9%) as moderate. MACE-30 developed in only 5 patients (3%). Of the 5 patients who developed Mace; The HEART score of 3 (60%) was determined as 5, whereas the heart score of 2 (40%) was 6. p <0.001. It was observed that no mace was detected in any patient with a low risk HEART score (p <0.001). The cut off value for the heart score was found to be ≤4 (p<0,001) while the cut off value for age was found to be ≤69 (p<0,001).

Conclusion: We think that patients presenting to the emergency with chest pain, a troponin value below LoD and a low HEART score can be discharged from the emergency department with a single troponin.

Keywords: Emergency service, angina, acute coronary syndrome, troponin

Öz

Amaç: Akut koroner sendrom tanısını hızlı ve doğru şekilde dışlamak önemlidir. Çalışmanın amacı, klinik değerlendirme ve elektrokardiyogarfisi (EKG) uygun hastalarda, tek troponin değeri ile akut miyokard enfarktus (AMI) tanısını dışlamaktır.

Gereç ve Yöntem: Acil serviste AMI ön tanısı ile izlenen ve HEART score hesaplanan hastalar arasından; high sensitive troponin I sonucu limit of detection (LoD) değeri altında saptanan ve taburcu edilen hastalar çalışmaya alındı. Tüm hastalar taburculuğun 30. gününde telefon ile arandı. Son 30 gün içinde "major adverse cardiac events" (MACE-30) durumları sorgulandı.

Bulgular: Çalışmadaki 122 hastanın (73.1%) HEART score low risk, 45 hastanın (26.9%) HEART score moderate risk olarak bulundu. MACE-30 sadece 5 hastada (3%) gelişmiştir. Mace gelişen toplam 5 hastadan; 3 ünün (60%) HEART score 5, 2 sinin (40%) heart skoru 6 olarak saptandı. p<0,001. HEART score low risk olan hiçbir hastada mace saptanmadığı görüldü. (p<0,001). Heart skoruna yönelik cut off değeri ≤4 olarak bulundu. (p<0,001). Yaş için cut off değeri ≤69 bulunmuştur. (p<0,001).

Sonuç: Göğüs ağrısı ile acil servise başvuran, troponin LoD değerinin altında olan ve düşük HEART skorlu hastaların acil servisten tek troponin ile taburcu edilebileceğini düşünüyoruz.

Anahtar Sözcükler: Acil servis, anjina, akut koroner sendrom, troponin

Corresponding *(İletişim)*: Bahadır Çağlar, Balikesir University School of Medicine Department of Emergency Medicine, Balikesir, Turkey
E-mail *(E-posta)*: mail@bahadircaglar.com
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INTRODUCTION

Millions of people present to emergency departments with chest pain complaints worldwide.[1] Acute coronary syndrome (ACS), one of the main and most important causes of chest pain, is a definition that covers the situations in which the myocardial cell is damaged reversibly or irreversibly. One of the main causes of this damage is the inability to supply the oxygen needs to the myocardial cell. The duration of oxygen deprivation of myocardial cells affects the extent of myocardial damage, and the extent of the damage affects the patient's mortality and morbidity. The diagnosis of ACS, which consists of unstable angina pectoris, ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI), is made with the patient's history, electrocardiography (ECG) findings, and cardiac biomarkers. Currently, highly sensitive troponins are used as cardiac biomarkers. The use of new generation troponins allows us to measure lower troponin concentrations, making it easier to diagnose and exclude ACS in the early period.

80-90% of the patients who present to the emergency department with chest pain are diagnosed other than ACS.[2-4] Therefore, it is also important to exclude the diagnosis of ACS in the emergency department quickly and accurately. In recent years, strategies have been developed to identify patients without AMI (acute myocardial infarction) and to exclude AMI diagnosis more rapidly.[2-10] One of these strategies is to demonstrate that AMI can be excluded with a single troponin if the troponin value at presentation is below the limit of detection (LoD).

Details of the patient history and laboratory errors are among the obstacles for physicians to exclude the diagnosis of AMI with a single troponin value.[8,11] Using clinical evaluation and ECG in addition to troponin to exclude the diagnosis of AMI will make patient management safer. This study aims to exclude the diagnosis of AMI with a single troponin value in patients with appropriate clinical evaluation and ECG.

MATERIALS AND METHODS

The study was initiated after obtaining the permission of Balıkesir University Clinical Research Ethics Committee, dated 08.04.2020 and numbered 2020/47. Patients who were admitted to Balıkesir University Hospital emergency service between October 2019 and July 2020 were examined. Among the patients followed up in the emergency department with a pre-diagnosis of AMI; 192 patients with no STEMI findings on ECG, who had a value below LoD as a result of high sensitive troponin I (hsTnI) at the time of admission and who were discharged from the emergency room by the primary physician after emergency room follow-up were included in the study. The HEART (history, ECG, age, risk factors and troponin) scores of the patients were calculated, and according to scores, 0-3 points were assigned as "low risk", 4-6 points as "moderate risk" and 7-10 points as "high risk", which is consistent with the literature (**Table 1**).[2]

Table 1. Composition of the HEART score[2]

HEART Score	Score	
History	Highly suspicious	2
	Moderately suspicious	1
	Slightly suspicious	0
ECG	Significant ST depression	2
	Nonspecific repolarisation disturbance	1
	Normal	0
Age	≤65 year	2
	45-65 year	1
	<45 year	0
Risk factors	≥3 risk factors or history of atherosclerotic disease	2
	1 or 2 risk factors	1
	No risk factors known	0
Troponin	>2x normal limit	2
	1-2x normal limit	1
	≤normal limit	0

Blood samples for hsTnI at the time of arrival were collected by gel tube (BD Vacutainer SST II). Blood samples were studied in the hospital central laboratory using Unicel DXI 800 and Beckman Coulter device with ACCESS hsTnI (RefB52699) kit and chemiluminescent immunoassay two step immunoenzymatic (sandwich) method. The LoD value of the kit is <2.3ng / l. All patients were called on the 30th day of discharge. The status of "major adverse cardiac events" (MACE-30) in the last 30 days was questioned.

Statistical Method: SPSS 26.0 (IBM Corporation, Armonk, New York, United States) program was used in the analysis of variables. The normality distribution of univariate data was evaluated using the Shapiro-Wilk francia test. Mann-Whitney U test as well as Monte Carlo results were used to compare two independent groups according to quantitative data. In the comparison of categorical variables, the Fisher Exact test and the Fisher-Freeman-Holton test results were tested with the Monte Carlo Simulation technique, and the column proportions were compared and expressed according to the Benjamini-Hochberg corrected p-value results. Relative risk values were calculated with 95% confidence intervals to examine the rate of development of the MACE-30 (or occurrence) of those with a risk factor relative to those without. The sensitivity and specificity ratios for the relationship between the classification separated by the cut-off value calculated according to the variables of the groups and the actual classification were examined and expressed by ROC (Receiver Operating Curve) curve analysis. Quantitative variables were expressed as mean ± SD (Standard Deviation) and Median (Minimum / Maximum) in **tables**, while categorical variables were shown as n (%). Variables were analyzed at a 95% confidence level and a p value of less than 0.05 was considered significant.

RESULTS

Evaluations were made on 167 patients (86.9%) who were contacted by phone on the 30th day of discharge. Patients who could not be reached were checked through the national death reporting system to exclude mortality risk, and no patients who died were found.

52.1% of 167 patients in the study were male (n: 87) and the mean age was 42.54 ± 13.72 (min: 19 - max: 83). The HEART score of 122 patients (73.1%) was found to be low risk and 45 patients (26.9%) as moderate risk. No patient with a high risk score was found. The HEART score mean value of the patients was found to be 2.44 ± 1.58 (min: 0 - max: 6) (**Table 2**).

MACE-30 developed in only 5 patients (3%). No exitus was found in those patients. Of the 5 patients who developed Mace, the HEART score of 3 (60%) was determined as 5, and the heart score of 2 (40%) was 6. p <0.001. It was observed that no mace was detected in any patient with a HEART score as low risk (p <0.001). The cut off value for the heart score was found to be ≤4. <0,001 SEN %100 SPE 95,1% AUC (SE): 0,976 (0,011). The mean age of 5 patients who developed MACE-30 was 71 (min: 53 - max: 83), and the mean age of patients without MACE-30 was 39.5 (min: 19 - max: 73). The cut off value for age was found to be ≤69 (p<0,001 SEN 80% SPE 96,9% AUC (SE): 0,944 (0,043) (**Table 3**, **Figure 1,2**).

Table 2. Distribution of patients according to age, sex, heart score and MACE-30

	Mean±SD.	**Min- Q1- Q2- Q3- Max**
Age	42,54±13,72	19- 34- 40- 53
	n	**%**
Sex		
Female	80	47,9%
Male	87	52,1%
	Mean±SD.	**Min- Q1- Q2- Q3- Max**
Heart Score	2,44±1,58	0- 1- 3- 4 -6
	n	**%**
Heart Score		
0	26	15,6%
1	22	13,2%
2	34	20,4%
3	40	24,0%
4	32	19,2%
5	8	4,8%
6	5	3,0%
Heart Score		
low risk	122	73,1%
moderate risk	45	26,9%
MACE-30 days		
absent	162	97,0%
present	5	3,0%

SD.:Standard Deviation, Q1: Percentile 25, Q2: Percentile 50 (Median), Q3: Percentile 75

Table 3. Relationship of age, sex and heart score to MACE-30

	MACE-30 days		**P**
	absent (n=162) n (%)	**present (n=5) n (%)**	
Sex			0,671 fe
Female	77 (47,5)	3 (60,0)	
Male	85 (52,5)	2 (40,0)	
	Median (Min / Max)	**Median (Min / Max)**	
Age	39,5 (19 / 73)	71 (53 / 83)	<0,001 u
	n (%)	n (%)	
Age			<0,001 rc
≤69	157 (96,9) sp	1 (20,0)	AUC (SE): 0,944 (0,043)
>69	5 (3,1)	4 (80,0) ss	70,22 (8,72-565,4) rr
	Median (Min / Max)	**Median (Min / Max)**	
Heart Score	2 (0 / 6)	5 (5 / 6)	<0,001 u
	n (%)	n (%)	
Heart Score			<0,001 ff
0	26 (16,0) B	0 (0,0)	
1	22 (13,6) B	0 (0,0)	
2	34 (21,0) B	0 (0,0)	
3	40 (24,7) B	0 (0,0)	
4	32 (19,8) B	0 (0,0)	
5	5 (3,1)	3 (60,0) A	
6	3 (1,9)	2 (40,0) A	
Heart Score			<0,001 rc
≤4	154 (95,1) sp	0 (0,0)	AUC (SE): 0,976 (0,011)
>4	8 (4,9)	5 (100,0) ss	124,9 (7,3-2144,8) rr
Heart Score			0,001 fe
low risk	122 (75,3) B	0 (0,0)	29,4 (1,7-521,5) rr
moderate risk	40 (24,7)	5 (100,0) A	

fe Fisher exact Test(Exact), u Mann Whitney U test(Monte Carlo), ff Fisher freeman Halton test(Monte Carlo); Post Hoc Test: Benjamini-Hochberg correction, rc Roc Curve Analysis (Youden index J - Honley&Mc Nell), rr Relative Risk (%95 Confidence intervall), A Significant for absent Mace-30 day, B Significant for present Mace-30 day, AUC: Area under the ROC curve, SE: Standard Error

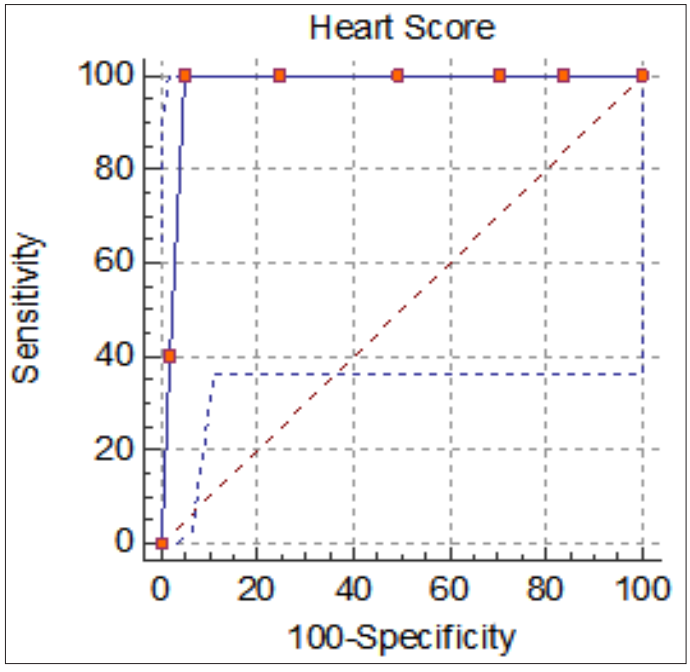

Figure 1. Roc analysis of the sensitivity and specificity ratios for the heart score by the cut-off value

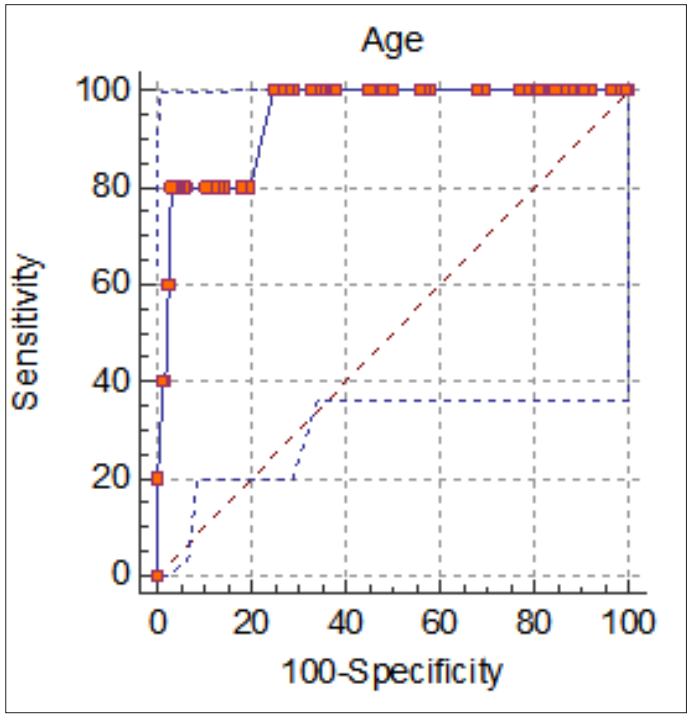

Figure 2. Roc analysis of the sensitivity and specificity ratios for the age by the cut-off value

DISCUSSION

Emergency services meet an increasing workload in our country as in worldwide and have an important place in health systems. For this reason, it is very important to use emergency services effectively. Patients who are followed up in emergency services with a pre-diagnosis of AMI have an important share. According to current guidelines, patients with chest pain are followed up with troponin every 3 hours.[12] Testing control troponin from a patient will extend the patient's stay in the emergency room from approximately 1 hour to 4 hours, if we also calculate the laboratory time of the blood sample.

In our study, we aimed to find out whether eligible patients can be discharged from the emergency department with a single troponin by examining the relationship between HEART score and MACE-30 in patients with troponin values below LoD. In our study, the rate of MACE-30 was found to be 2.9% (5 patients) in patients who were followed up with a pre-diagnosis of AMI, whose troponin value was below LoD, and who were discharged from the emergency department by the primary physician. The HEART score of the patients who developed MACE-30 was found to be 5 and above, and 4 of the 5 patients were> 69 years old.

In the literature, there are studies showing that if the troponin result is below the limit of blank (LoB) or LoD, patients can be discharged with a single troponin, thus reducing the hospital stay and cost.[6-10,13-17] In the study conducted by Bandstein et al on 14636 patients, it was stated that patients with troponin values below the LoD value and without signs of ischemia in their ECG can be safely discharged from the emergency department.[8]

However, an increase in troponin may not be detected in the first hours after the infarction begins.[12] Therefore, troponin results should not be merely interpreted.[18] For this reason, we combined troponin value with heart risk score in this study as we think that the HEART score is easily applicable in emergency services. When calculating the HEART score, a score between 0 and 10 points is created based on the patient's history, age, risk factors, ECG findings, and troponin result.[2] In HEART scoring; the most critical age group is ≥65 and 0-3 point range is stated as low risk.[19,20] In our study, we found the 0-4 score range and age <69 as low risk. However, when we consider the limited number of patients, we observe that we have reached parallel results with the HEART scoring system.

In addition, thanks to the developing technology and widespread network, we think that informatics in healthcare will advance, thus these scores will be calculated automatically in digital environment by considering the patient's history in the following years, which may help physicians in the management of patients with chest pain with decision support systems (DSS).[1]

Limitations: The main limitations are that our study was conducted in a single center, 13.1% of the patients could not be reached, and the total number of patients was limited. The limited number of our patients is one of the main limitations. Multicenter studies with larger numbers of patients are needed to make cut off values more indicative. In addition, not focusing the diagnosis of discharge is one of the deficiencies of our study.

CONCLUSION

Acute coronary syndrome, which is the leading cause of death in the world, is diagnosed in the emergency department. In our study, AMI or MACE-30 did not develop within 30 days in patients with troponin levels below LoD and low HEART scores. We think that patients who meet these criteria can be discharged from the emergency department with a single troponin.

ETHICAL DECLARATIONS

Ethics Comittee Approval: This study was conducted with the Balikesir University Clinical Research Ethic Committee with decision no. 2020/47.
Informed Consent: Written informed consent was obtained from all participants who participated in this study.
Status of Peer-review: Externally peer-reviewed.
Conflict of Interest Statement: The authors have no conflicts of interest to declare.
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