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The Veracity of Troponin Test Requests for Patients Presenting to the Emergency Department with Chest Pain; a Clinical Audit

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Abstract

Introduction: Troponin test is one of the methods for diagnosing acute coronary syndrome, but the overuse and misuse of this test has increased the costs imposed on the health system and the patients.

Objective: The present study was conducted to investigate the veracity of troponin test requests for patients presenting to an emergency department with chest pain and examine the effectiveness of training emergency medicine assistants in reducing unnecessary and inappropriate requests in emergency departments.

Methods: This clinical audit was conducted in the emergency department of Imam Hossein Hospital, Tehran, Iran, in 2014. Sampling was carried out using the census method and all the cases presenting to the emergency department for whom a troponin test was requested by the emergency medical assistants were included in the research. First, the veracity of the current troponin test requests was assessed; then, training was given to the personnel, and the veracity of the troponin test requests was once again verified after the training was completed. The rate of veracious troponin requests for the patients was measured based on two factors, including the interval between the patients' admission and the troponin test request, and the interval between the onset of pain and the troponin test request. The veracity of the troponin test request was compared before and after training using the Phi test and Cramer's V test in IBM SPSS-21.

Results: This study examined a total of 500 patients (250 before training and 250 after), who had a mean age of 57.65±18.15 years, including 51.6% men. Significant differences were observed between the mean time of the patients' admission and the overall and post-training troponin test results (P=0.000), and also between the mean time of the onset of pain and the overall and post-training troponin test results (P=0.000). The number of positive troponin test results did not differ significantly between the patients in either of the two stages (P=0.39).

Conclusion: Unnecessary troponin test requests reduced significantly after this clinical audit in the examined emergency department.

Key words: Chest pain; Clinical audit; Emergency department; Internship and Residency; Troponin

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INTRODUCTION

Chest pain is one of the most common complaints of patients admitted to emergency departments that can have many different causes, with acute coronary syndrome being one of the most important ones (1-4). Coronary artery diseases (CAD) are one of the main health problems in advanced societies, and an average of eight million patients are treated for chest pain in emergency departments every year. About 30% of these patients are diagnosed with acute coronary syndrome (2, 5, 6). In addition to accurate history-taking and physical examination, an electrocardiogram (ECG) is also performed and certain enzymes are measured in the diagnosis process of these patients (1). Troponin is one of the enzymes measured through laboratory tests and is a protein that controls the link between actin and myosin and plays a major role in the contractions of the skeletal muscles, including the heart muscle. Troponin T and Troponin I are some of the markers that show damage to the heart muscles. Under normal circumstances, this protein cannot be measured, but its levels increase six to 12 hours following damage to the heart muscles, reaching its maximum in 24 hours and returning to its basal levels in about two weeks (7, 8). According to the

existing guidelines, troponin tests can be requested for patients with chest pain of potentially cardiac origin upon the patients' admission, six to 12 hours after its first measurement and also 12 to 24 hours after the onset of the symptoms (9, 10). Although performing this test has a key role in the diagnosis, prognosis and classification of the risk of acute coronary syndrome, its overuse and inappropriate requests increase laboratory personnel's workload, the costs imposed on the health system, unnecessary hospital stays and the costs incurred by the patients (11-13). The present study was therefore conducted to examine the veracity of troponin test requests for patients presenting to an emergency department with chest pain and the effectiveness of training emergency medical assistants in reducing unnecessary and inappropriate requests in emergency departments.

METHODS

Study design

The present clinical audit was conducted at the emergency department of Imam Hossein Hospital, Tehran, Iran, in 2014. The study protocol was approved by the research council of the said hospital and also the ethics committee of Shahid Beheshti University of Medical Sciences.

Study population

Sampling was carried out using the census method and all the cases presenting to the emergency department for whom a troponin test had been requested by the emergency medical assistants were included in the research and no exclusion criteria were set. Data were collected using a researcher-made checklist containing the demographic details of the patients, the details of their chest pain and the time of their troponin test request.

Data collection & intervention

Phase one: First, the current state of the veracity of troponin test requests was assessed for 250 patients. Phase two: Next, over two 2-hour sessions, all the emergency medical assistants working in the study hospital received training on the right conditions and time for troponin test requests based on reliable guidelines (14, 15). Phase three: After the completion of training, 250 patients admitted were assessed using the checklist used in phase one.

Statistical analysis

Data extracted from the checklists and classified by subject were analyzed in SPSS-21. The interval variables were shown with the mean and standard deviation. The nominal variables were reported as frequency and percentage. The veracity of the troponin test requests for the patients was determined based on two factors, including the interval between the patients' admission and the troponin test request, and the interval between the onset of pain and the troponin test request. The veracity of the troponin test requests was compared before and after training using the Phi test and Cramer's V test.

RESULTS

A total of 500 patients (250 before training and 250 after) with a mean age of 57.65±18.15 years were assessed, including 258 (51.6%) men. Table 1 presents the patients' demographic details before and after training. No significant differences were observed in the patients' gender ratio in either of the two phases (P=0.42). Before training, the mean

Table 1: Demographic variables and baseline characteristics of studied patients in two groups

Variable	Before Training	After Training
	Number (%)	
Gender		
Female	118 (47.2)	127 (50.8)
Male	132 (52.8)	123 (49.2)
Chest pain complaints		
Yes	218 (84.8)	244 (97.6)
No	38 (15.2)	6 (2.4)
Duration from the onset of pain to the test request		
Less than one hour	64 (25.6)	12 (4.8)
1-2 hours	91 (36.4)	94 (37.6)
3 hours and more	95 (38.0)	144 (57.6)
Type of chest pain		
Typical	126 (57.8)	101 (40.4)
Atypical	92 (42.2)	143 (57.2)
Troponin test result		
Positive	5 (2.0)	8 (3.2)
Negative	245 (98.0)	242 (96.8)

Table 2: The veracity of the troponin test requests based on the interval between the patients' admission and the test request before and after the training

Troponin Test Result		Number (%)	Mean ± SD of the Interval (minute)	p
Before training	Positive	5(2.0)	31.0±17.8	0.152
	Negative	245(98.0)	23.3±11.7	
After training	Positive	8(3.2)	46.3(3.5)	0.000
	Negative	242(96.8)	27.5±10.7	
Overall	Positive	13(5.2)	40.4±13.1	0.000
	Negative	487(94.8)	25.4±11.4	

Table 3: The ordinal mean difference between the time of the onset of pain and the patients' admission in terms of the troponin test results before and after the training

Troponin Test Result		Number (%)	Mean ± SD of the Interval (minute)	p
Before training	Positive	5(2.0)	165.8±34.3	0.18
	Negative	245(98.0)	124.7±41.7	
After training	Positive	8(3.2)	178.5±22.4	0.015
	Negative	242(96.8)	123.8±31.6	
Overall	Positive	13(5.2)	348.4±42.7	0.007
	Negative	487(94.8)	247.9±36.2	

and standard deviation of age was calculated as 57.7±19.5 years in the male patients and 53.0±20.9 years in the female patients, and after training, these figures were 61.9±16.9 years in the men and 58.0±14.3 years in the women. A significant difference was observed in the mean age of the patients before and after training (P=0.04). The patients' troponin test results did not differ significantly in relation to training either (P=0.39).

The veracity of the troponin test requests for the patients was determined based on two factors, including the interval between the patients' admission and the troponin test request, and the interval between the onset of pain and the troponin test request. Given that time could be accessed in minutes and as intervals, the first factor was assessed using the student T-test. The results obtained showed significant differences between the overall and the post-training troponin test results in the mean time of the patients' admission with a 99% confidence interval; in other words, the mean time from the patients' admission to the troponin test request was higher in the patients with positive test results compared to those with negative results (Table 2). Although the mean interval was higher in the patients with positive tests before the training, the difference was not statistically significant.

The second factor (the time of the onset of the symptoms of pain) was determined using Mann-Whitney's U-test, because it was not possible to determine the exact time of the onset of pain in the form of intervals, and since this variable had been measured as ordinal and in three dimensions. The results obtained showed significant differences between the overall and the post-training troponin test results and the mean time of the onset of pain with a 95% confidence; in other words, the ordinal mean interval between the onset of pain and admission to the emergency department was higher in the patients with positive troponin test results compared to those with negative results (Table 3). Although the ordinal mean interval was higher in the patients with positive troponin test results before the training, the difference was not statistically significant.

Discussion

According to the results obtained and the statistical analysis, the training intervention performed in this clinical audit was significantly effective in reducing the cases of unnecessary troponin test requests by emergency medical assistants for patients presenting to the said emergency department with chest pain.

The patients' mean age was 57 years in this study, which is somewhat lower compared to similar studies (16, 17). The present findings showed significant differences between the overall and the post-training troponin test results and the mean time of the patients' admission, which has similarly been reported in previous studies. Nonetheless, no significant relationships were observed in the troponin test results between the patients with chest pain and typical symptoms compared to the atypical cases, which disagrees with the results obtained in previous studies (18, 19). In a study on the efficacy of measuring cardiac biomarkers in the diagnosis of patients with acute coronary syndrome, Shams Vahdati et al. reported that these tests have a 72% sensitivity and a 86% specificity in diagnosing myocardial infarction, but none of

these biomarkers were reported to be positive in cases of stable chest angina (12), and the troponin test results were also negative in the majority of the patients in the present study. In a study by Doolub et al. on troponin test requests for patients, 40% of the requests were inappropriate and imposed an additional cost of 320 Euros (16). To prevent the unnecessary use of laboratory tests for measuring cardiac enzymes, Larochelle et al. prepared guidelines to remove creatine kinase and cardiac creatine kinase tests from the existing diagnostic measures and developed troponin test request indications according to the existing guidelines, and trained the medical personnel on these guidelines over several sessions. By the end of the study, the interventions performed led to an increase of 38.4% in the veracious request of cardiac biomarker testing and an annual cost reduction of 1.25 million dollars compared to before implementing these guidelines (20). Similarly, in the present study, which only used training for its intervention, a significant reduction was observed in unnecessary troponin test requests.

Limitations

The limitations of this study include the failure to analyze factors such as type of work shifts and the test-requesting assistant's skills and also the failure to take note of the interval between the troponin test request by the emergency medical assistant and the nurse's implementation of the test. Moreover, calculating the financial burden caused by unnecessary requests and the comparison of this figure before and after training would have added to the value of the findings. The failure to follow up on the patients until their final diagnosis was one of the most important limitations that affected the interpretation of the results significantly.

Conclusions

The present clinical audit resulted in a significant reduction in unnecessary troponin test requests and the training intervention given thus appears to have been effective.

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Authors' contribution

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

Conflict of interest

The authors declare that they have no conflicts of interest with regard to this study.

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