

Cardiac panel evaluation of usak state hospital stat laboratory

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Abstract

Aim: In this study, we aimed to determine clinical usefulness and advantages of ordering tests that include total creatine kinase (CK), creatine kinase myocardial band (CK-MB, enzymatic), troponin I, myoglobin, and CK-MB (mass) in stat laboratory of our hospital with an assessment according to patients diagnoses in Usak region.

Materials and Methods: Four hundred thirty-eight patients presenting to Usak State Hospital Stat Laboratory between March 2010 and April 2010 were included in this study. CK, CK-MB (enzymatic), troponin I, myoglobin, and CK-MB (mass) levels, diagnosis, and hospitalization were evaluated.

Results: Among the total of 107 patients, 41 (9,3%) were hospitalized to coronary intensive care unit, 13 (2,9%) to cardiology service, 13 (2,9%) to chest disease service, 10 (2,2%) to internal medicine service, 10 (2,2%) to neurology service, 5 (1,1%) to chest disease intensive care unit, and 15 (3,4%) to other services (24,4%). The preliminary diagnosis and second diagnosis after hospitalization were found same (89,9 %).

Seventy-eight (17,8%) patients had troponin level over the upper reference limit of 0,06ng/mL (mean±SD;5,130±11,682 (0,06-50) ng/mL); 108 (24,6%) patients had myoglobin level over the upper reference limit of 110ng/mL. Sixteen (3,65) patients were diagnosed with AMI.

Discussion: In our study, we found that nearly half of the patients ordering cardiac marker tests in the stat clinical biochemistry laboratory were hospitalized associated with cardiovascular system services. The preliminary diagnosis and second diagnosis after hospitalization were found the same (89,9 %) and this value was evaluated as good in terms of clinical practice. Early diagnosis of acute coronary syndrome (ACS), hospitalization to an appropriate service, and treatment or timely invasive procedures are provided to shorten hospital stay and improve disease prognosis.

Keywords

Stat laboratory; Cardiac panel; Troponin

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Introduction

A significant proportion of patients admitted to the Emergency Room (ER) with chest pain are diagnosed with Acute Coronary Syndrome (ACS) [1]. All of the clinical pictures associated with acute myocardial ischemia are defined as ACS [2]. In the USA, 500.000 people die every year due to Coronary Artery Disease (CAD) [1]. The early diagnosis of these patients is very important in terms of guiding their treatment [3].

Mortality and morbidity are positively affected by early diagnosis of the disease and especially by timely administration of thrombolytic therapy and interventional applications, and it is easier to control the complications that may arise during follow-up of the disease [3].

The incidence of Acute Myocardial Infarction (AMI), severity, social and economic cost, responsibility for medical intervention are very important health problems in terms of community and health policies [4,5]. According to the World Health Organization, the diagnosis of AMI is based on the presence of at least two of three criteria: clinical presentation, electrocardiography change, and an increase in creatine kinase-myocardial band (CK-MB) [6]. Identification of serum cardiac markers plays a key role in the diagnosis of AMI. In recent years, myoglobin, CK-MB mass and troponins have been used more widely in clinical practice [7]. Studies have shown that 4-6% of patients with ACS admitted to the ER are accidentally discharged from the ER as a result of misdiagnosis [8].

Cardiac markers are frequently used for differential diagnosis in patients who do not have chest pain with nonspecific symptoms such as headache, dyspepsia, myalgia, anxiety and nausea.

In this study, we aimed to examine the hospitalization rate of patients who applied to our hospital ER and who were requested for cardiac markers, what services they were admitted to and in what proportions, what initial diagnosis is requested for cardiac markers and the correct use of cardiac markers.

Material and Methods

Our retrospective study included 438 patients who applied the Stat Laboratory of Usak State Hospital ER with cardiac panel tests request between March 2010-April 2010. The study was approved by Usak State Hospital Ethical Committee.

The total creatine kinase (CK) activity was determined by measuring the NADPH formation rate at 340 nm while reducing the NADP to NADPH with a series of reactions using the hexokinase and glucose 6 phosphate dehydrogenase enzymes with CK NAC method in the Abbott Architect c 8000 analyzer. CK-MB (enzymatic) immunoinhibition activity measurement of a series of reactions using hexokinase and glucose 6 phosphate dehydrogenase enzymes measured the result of inhibition of creatinine kinase muscle band (CK-MM) activity of mouse antibodies in Abbott Architect c 8000. Troponin I, Myoglobin and CK-MB (mass) measurements were made by using direct chemiluminometric technology with sandwich immunometer using fixed amounts of various antibodies in Advia Centaur CP device.

Statistical analyzes were made with SPSS 11.5 package program. Cardiac marker parameters of the patients were given as mean \pm SD.

Results

One hundred and seven (%24,4) of 438 patients were hospitalized, of whom 41 (%9,3) were hospitalized to the coronary intensive care unit, 13 (%2,9) to the cardiology service, 13 (%2,9) to the pulmonary diseases service, 10 (%2,2) to the internal medicine service, 10 (%2,2) to the neurology service, 5 (%1,1) to the pulmonary diseases intensive care unit, 3 to the (%0,6) internal medicine intensive care unit, 3 to the (%0,6) nephrology service, 3 to the (%0,6) general surgery service, 2 (%0,4) to the surgical intensive care unit, 2 (%0,4) to the neurology intensive care unit, 1 (%0,2) to the psychiatric service and 1 (%0,2) to the enfectious diseases service. The preliminary diagnosis and second diagnosis after hospitalization were found the same (89.9 %).

The number of patients and percentages are given in Table 1 according to the preliminary diagnosis related with system.

There were 81 (18,4%) patients with total CK in the reference range (male 30-200 U/L; female 29-168 U/L) and CK-MB (activity) above the upper reference limit (>24U/L), without clinical AMI. The relationship between CK-MB (activity) and CK-MB (mass) values was evaluated by Pearson Correlation analysis and r-value was found to be low ($r = 0,094$) (Table 2) in this group of patients. There were 4 (0,9%) patients in this group with CK-MB (mass) values above the upper reference limit of 5ng/mL. The diagnoses of these patients were chronic kidney failure, CAD, CAD + heart failure and CAD + acute kidney failure.

There were 64 patients without clinical AMI with excess of the upper reference limit of the total CK. CK-MB (activity) value in 44 (68,7%) of these patients was above the upper reference limit.

Table 1. The number and percentages of patients according to the system related with preliminary diagnosis

	Total CK mean \pm SD (min-max) (U/L)	CK-MB (activity) mean \pm SD (min-max) (U/L)	CK-MB (mass) mean \pm SD (min-max) (ng/mL)	r value
Total CK level high (n=64) group	548 \pm 702 (169-4267)	52 \pm 93 (10-746)	7,13 \pm 8,78 (0,17-42,47)	0,208
Total CK in the reference range, CK-MB (activity) level high (n=81) group	86 \pm 38 (31-195)	40 \pm 23 (25-148)	2,19 \pm 1,85 (0,00-10,73)	0,094
AMI patient group (n=15)	1010 \pm 1044 (123-3101)	164 \pm 160 (33-477)	83,61 \pm 114,02 (5,70-300)	0,908

Table 2. Total CK high, Total CK in reference limit and AMI groups; Total CK, CK-MB (activity) and CK-MB (mass) mean \pm SD(min-max) values and r value between CK-MB (activity) with CK-MB (mass) .

	Patients (n=438)	%
Cardiovascular system	213	48,6
Psychiatry	58	13,2
Pulmonary system	49	11,1
Gastrointestinal system	44	10,0
Neurological problems	39	8,9
Urinary system	14	3,1
Other	21	4,7

There were 16 (3,65%) patients diagnosed with AMI. The relationship between CK-MB (activity) and CK-MB (mass) values was found to be high using Pearson Correlation analysis in AMI patients group ($r=0,908$).

The troponin value of 78 (17,8%) patients was above the upper reference limit of 0,06 ng/mL, the mean \pm SD was 5,130 \pm 11,682 (0,06-50) ng/mL. The myoglobin value of 108 (24,6%) patients was above the upper reference limit of 110ng/mL.

Discussion

Millions of patients apply to the ER every year with possible AMI symptoms; however the vast majority do not have AMI. Delays in AMI diagnosis may also affect the assessment of other underlying diseases. Rapid evaluation of these patients helps to prevent congestion in the ER and to eliminate medical and economic problems [9].

In our study, it was found that approximately half of the patients (48,6%) (Table 1) who were asked for cardiac markers from the stat clinical biochemistry laboratory were admitted to the services related to the cardiovascular system. It was later found that the patients whose cardiac requests were made, and who were hospitalized, most frequently were admitted to the related services due to problems related to psychiatry, gastrointestinal system, and respiratory system, respectively.

The preliminary diagnosis and second diagnosis after hospitalization were found same as 89.9 % and this value was evaluated as good in terms of clinical practice. In our study, as shown in Table 1, almost half ($n=213$) of the patients who had requests for cardiac markers received preliminary diagnosis related to the cardiovascular system at a rate of 48,6 %. The frequency of requests was followed as a preliminary diagnosis related to psychiatric ($n=58$, 13.2%) and respiratory system ($n=49$, 11.1%), respectively. It was thought that various cardiac problems including AMI in ER can be most frequently confused with psychiatric disorders and in second place, with respiratory system disorders. Keeping this information in mind by emergency physicians may be beneficial in terms of emergency practice.

Correlations coefficients between CK-MB activity and mass measurements of the two groups consisting of high total CK ($n=64$) group and total CK in the reference range and CK-MB activity measured high ($n=81$) group were better in high total CK group. However, correlation was not good for both groups between CK-MB activity and mass measurements (Table 2). This was in line with the results of a previous study in which we found no correlation between the results, of CK-MB activity and mass values with linear regression and correlation of two healthy groups [10]. Especially in the group where the total CK is in the reference range and the level of CK-MB activity is high, we thought that in emergency conditions, sampling may be related to the possibility of hemolysis more often due to taking the vascular access instead of the vacutainer. However, in our retrospective study, we were unable to obtain data on hemolysis. This situation can be accepted as the limitation of our study. Prospective studies can be conducted on this subject. Using Person Correlation analysis, the r value was found to be high in AMI patients group ($r=0,908$, Table 2) between CK-MB activity and CK-MB mass measurements. There was a positive

correlation between CK-MB activity and CK-MB mass value. These results show that CK-MB mass test is more reliable in the differential diagnosis in AMI patients.

There were 4 (0,9%) patients with a total CK in the reference range and CK-MB (activity) group above the upper reference limit whose CK-MB (mass) values were above the upper reference limit of 5ng/mL. The diagnoses of these patients were chronic kidney failure, CAD, CAD+heart failure and CAD+acute kidney failure. The follow up of these patients with serial measurements may be recommended. In addition, the total CK was below the lower reference limit and the CK-MB (activity) was above the upper reference limit in 5 patients, and in these patients, CK-MB (mass) values were within the normal limits. In such patients, the presence of hemolysis should be considered. The troponin value of 78 (17,8%) patients was above the upper reference limit and 16 of these patients were diagnosed with AMI. The remaining 62 patients had troponin elevations due to other existing diagnoses. These diagnosis were CAD, heart failure, chronic obstructive pulmonary disease, diabetes mellitus, pulmonary edema, acute bronchitis, hemiplegia, cerebrovascular diseases, acute myocarditis, and atrial fibrillation. It will be beneficial to consider these diseases in differential diagnosis at the height of troponin.

In our study, it was found that approximately half of the patients who were asked for cardiac markers from the stat clinical biochemistry laboratory were hospitalized in the services related to the cardiovascular system. With the early diagnosis of ACS, hospitalization in the appropriate service, and timely treatment or interventional procedures, patients hospital stay decreases and the prognosis of the disease improves.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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