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EC PHARMACOLOGY AND TOXICOLOGY

Short Communication

Combined Use of Troponin and CK-MB in the Prediction of Acute Myocardial Infarction in Patients with Acute Chest Pain

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Received: May 20, 2022; **Published:** May 31, 2022

DOI: 10.31080/ecpt.2022.10.00755

Abstract

In a prior study, we evaluated the two major serodiagnostic biomarkers for myocardial infarction, the inhibitory subunit of troponin (cTnI) and the MB isozyme of creatine kinase (CK-MB), for their abilities to diagnose acute myocardial infarction (AMI). We found that if both tests are positive in a cohort of 295 patients who do not have the complicating conditions of congestive heart failure (CHF) and/or end stage renal disease (ESRD), the positive predictive value is high (63%) even though the prevalence of MI was low (11.9%). These results suggested that the two tests could be combined in a bivariate logistical model based on linear regression to predict AMI in this population. Using this analysis, we found that the probability of MI function, G, was equal to 0.048[CKMB]+1.292[Troponin] allowing for construction of a nomogram that predicts probability of AMI based on the sum of the computed scores for cTnI and CK-MB values. We also have established a cutoff value for G of 0.28 where the overall sensitivity is 88.2% and specificity is 82.6% which are significantly higher than the corresponding values for the sensitivity of CK-MB and the specificities for both CK-MB and troponin alone.

Keywords: *Troponin; CK-MB; Acute Myocardial Infarction (AMI); End Stage Renal Disease (ESRD)*

In a recent publication [1], we assessed the first draw diagnostic efficacy of the two major serodiagnostic markers, the inhibitory subunit of troponin (cTnI) and the MB isozyme of creatine kinase (CK-MB). This study revealed that, using the standard cutoffs of 0.05 and 5.0 ng/mL for cTnI and CK-MB, respectively, the sensitivities for these two markers were, respectively, 89.4 and 66 and the specificities were, respectively, 73.3 and 70.6, suggesting that neither marker could be used on a stand-alone basis to diagnose acute myocardial infarction (AMI). However, we also found that two conditions, congestive heart failure (CHF) and end stage renal disease (ESRD), resulted in substantial numbers of false positive results for both markers and, by eliminating these cases, we found that there was a significant increase in specificities to 82.4 and 84.3 respectively [1].

We also found that we could identify patients (who did not have CHF or ESRD) at high risk for having AMI by requiring that both tests be positive. The positive predictive value (PPV) for positive cTnI and CK-MB rose dramatically to 63 percent from 38 percent for positive troponin alone. This result suggests that both markers should be used in the diagnosis of AMI. Although the sensitivity for diagnosis of AMI based on both tests' being positive was 66 percent, limiting the overall efficacy of this approach, the high PPV suggested that these two markers might be combined to render higher diagnostic efficacy.

To accomplish this goal, we performed binary logistical regression analysis on dichotomized troponin and CK-MB [2] using the data from our former study [1] for patients who did not have either CHF or ESRD. The β-weighted variables were used to acquire a summary measure based on the linear function,

Where x_1 is troponin value, x_2 is CK-MB value, and B_1 and B_2 are the respective optimized coefficients from linear regression. G(MI) is a function of the probability of occurrence of MI that we determined for each set of values. Regression analysis was performed using the least squares best fit approach giving the minimum value for kappa [2].

The binary logistics regression model was then used to create a nomogram to guide the clinicians in interpreting the quantitative results of troponin and CK-MB results. In addition, the receiver operator curve (ROC) curve and the area under this curve (AUC) were determined for the above model.

Applying this method to our patients without ESRD or CHF, we obtained the following equation:

G(MI) = 0.048[CK-MB] + 1.29[troponin] (2).

We then constructed an ROC for the combined values of troponin and CK-MB using different values of G(MI) in equation 2. The AUC of the combined measure for predicting was 0.921, while the AUC is higher than troponin alone (0.894). At a cutoff for G(MI) of 0.188 the model achieved sensitivity of 94.1% (2 false negatives) and specificity of 58.8% while at a cutoff of 2.081 the model achieved a sensitivity of 50% and specificity of 99.2%. Overall, the most optimal cutoff for G(MI) is 0.28 wherein the sensitivity is 88.2% and specificity is 82.6%.

The kappa coefficient for dichotomized combined CK-MB and troponin was 0.621 (asymptotic p-values based on Chi-squared test was < 0.0001). This shows improved agreement between the combined test result and myocardial infarction compared to testing either troponin or CK-MB alone.

As shown in figure 1, we created a nomogram for combined troponin and CK-MB testing to serve as a visual guide for clinicians assessing the quantitative values of these two tests. Using the nomogram, based on results of troponin and/or CK-MB, a score is assigned to the patient. If both tests are performed, then the scores of the two tests are added. Each score is assigned a probability, with scores of 3 or more having an almost 100% certainty of myocardial infarction. This nomogram allows the direct determination of the likelihood that a patient with AMI can be detected with high sensitivity and specificity even in the presence of low prevalence.

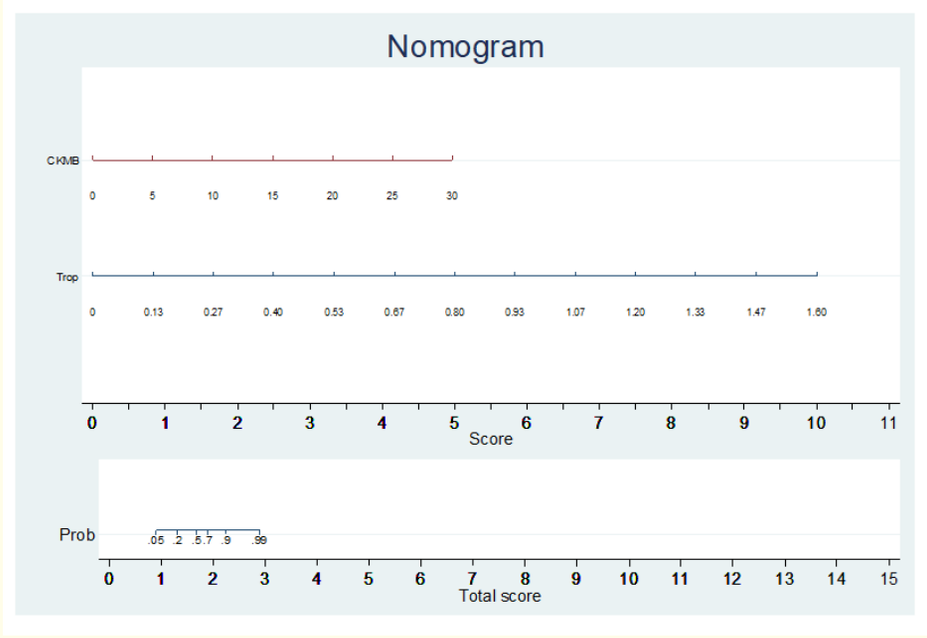

Figure 1: *Nomogram depicting the CK-MB and troponin levels and the corresponding scores in the above panel and probability associated with each score in the panel below.*

Bibliography

1. Laskar DB., *et al*. "Evaluation of the Efficacy of the Serodiagnostic Markers, CK-MB and Troponin, in the Acute Diagnosis of Myocardial Infarction". *EC Pharmacology and Toxicology* 10.4 (2022): 115-123.

2. Momani A., *et al*. "Introduction to Statistical Methods, Pathology". Springer (Cham, Switzerland) (2018): 168-173.

Volume 10 Issue 6 June 2022