
# *Modified HEART Score Using the Derived 12-Lead ECG and a Cardiac Electrical Biomarker*

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***Annals of Emergency Medicine*** **October 2017 Volume 70, Issue 4, Supplement, Page S18**

**Background:** The HEART score is used to stratify risk for patients presenting with chest pain suggestive of acute coronary syndrome (ACS) and is comprised of elements including history (H), 12-lead ECG changes (E), age (A), risk factors (R) and troponin (T). The troponin concentration (cTn) is usually available within 1 hour of patient presentation. The measured 12-lead ECG (mECG) can be derived (dECG) from 3 measured leads with high correlation. A new cardiac electrical biomarker (CEB®) that has correlation with troponin can be instantaneously constructed from the dECG on a cardiac monitor with reportedly high diagnostic accuracy for detection of acute myocardial ischemic injury (AMII).

**Objective:** Compare the HEART risk score to modified HEART risk scores that includes substitution of the dECG for mECG changes and the CEB® for troponin.

**Methods:** This is a cross-sectional study of 137 consecutive patients presenting to an emergency facility with complaints of chest pain. The prevalence of AMII was 14.9% including 7 STEMI, 12 Non-STEMI and 1 unstable angina. All patients had a 12-lead mECG and serum troponin I on presentation. The dECG was constructed from leads {I, II, V2} continuously directly from a cardiac monitor/ECG device (Vectraplex ECG System, VectraCor Inc, Totowa, NJ). The CEB® was constructed from the dECG in real-time and displayed on the cardiac monitor. The HEART risk score was calculated and compared to a $HE_dART$ score that utilized the dECG, $HEART_{ceb}$ that used the CEB, and a $HE_dART_{ceb}$ that used both the dECG and CEB® in their calculations. Pearson correlation was used to compare the dECG and mECG. Spearman correlation and ROC curve analyses were used to compare the risk scores. The disposition of each patient was tabulated and compared using each risk score.

**Results:** The dECG and mECG showed high correlation (r = 0.81). The CEB® showed high diagnostic accuracy with sensitivity 85%, specificity 90%, and negative predictive value 95%. HEART vs. HEdART, HEARTceb and HEdARTceb showed high Spearman correlations of .9,.9,.9 respectively. The ROC curves for all HEART, HEdART, HEARTceb, and HEdARTceb risk scores were constructed showing area-under-curves (AUC) of .8, .8,.8.and .8 respectively. No statistically significant differences among the risk scores were noted.

**Conclusion: The modified $HE_dART_{ceb}$ score using the dECG and CEB® appears to perform well in risk stratification of patients presenting with chest pain and is comparable to the customary HEART score. Further studies are warranted to validate the findings of this exploratory study.**