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Cardiac troponin T in the early detection for myocardial ischemia

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Keywords

Acute chest pain, cardiac troponin CK-MB, cTnT, myocardial injury

Comments

This paper investigated whether a new biochemical assay, previously studied in highly selected high risk cardiac patients, is applicable to a large racially mixed urban emergency department population. The results are interesting in that cTnT was able to identify those without AMI who have a high risk of cardiac complications. However, there is a high apparent false-positive rate of 9%. The authors argue that this may represent subclinical myocardial injury but have no evidence to support this claim. Perhaps the most useful clinical application of cTnT is to rule out serious cardiac disease, as the negative predictive value of 99.8%, is significantly better than that for CK-MB measurement. For the intensivist this will remain an interesting but unhelpful assay in day-to-day management of ICU patients. This is mainly due to the fact that there is a false-positive rate of 70% for cTnT levels in renal failure. If validated this assay may be useful in early risk stratification of patients presenting with acute chest pain.

Introduction

Clinical assessment of patients presenting with acute chest pain in the textbook manner of history, examination, (electrocardiogram) and chest X-ray is reliable only in the most overt of cases. Significant numbers of patients with equivocal history or ECG still go on to develop serious cardiovascular complications. In recent years serial estimates of creatine kinase-MB isoenzyme (CK-MB) have been widely used to confirm a diagnosis of myocardial infarction. Unfortunately single measurements of CK-MB are not specific or sensitive enough to be clinically useful in making a diagnosis or in guiding further management. Several recent reports suggest that cardiac troponin T (cTnT) levels may be more helpful in the diagnosis of myocardial ischemia, particularly in less severe myocardial injury such as that in patients with unstable angina.

Previous studies have suggested that cTnT has good sensitivity in the diagnosis of myocardial infarction, and is useful in predicting prognosis in patients with unstable coronary syndromes. These studies have been of hospitalized, predominantly white patients with unstable high risk ischemic heart disease.

Aims

To prospectively evaluate the diagnostic performance of cTnT measurement in a lower risk racially mixed population presenting with acute chest pain.

Methods

The study population consisted of 1477 patients admitted to the emergency department presenting with cardiac chest pain. Patients were included if they had at least two measurements of cTnT performed within 24 h of presentation. A total of 1303 patients (88%) fulfilled this criterion.

Clinical data and ECG were recorded. Blood was drawn usually at eight hourly intervals for cardiac enzyme measurements. cTnT was measured at the same time. Total CK was assayed by a clinical analyzer. CK-MB was measured by two methods. For the first 744 patients an ion-exchange chromatography and immunoinhibition assay was used. After this date a mass assay using monoclonal antibody was used (n = 559 patients). cTnT was measured by immunoassay using complementary monoclonal antibodies.

Diagnosis of acute myocardial infarction (AMI) was made using the standard criteria of ECG changes, characteristic cardiac enzyme patterns, or angiographic findings. Only those AMI's occurring within 24 h of admission were analyzed.

Unstable angina (UA) was a clinical diagnosis based on the typical history alone.

Major cardiac events were defined as cardiogenic shock, cardiac arrest, ventricular tachycardia (VT), ventricular fibrilation (VF), second or third degree heart block requiring pacing, use of intra-aortic balloon pump, intubation, coronary artery bypass surgery (CABS), or angioplasty (PTCA). Only events occurring within 72 h after admission were included.Sensitivity, specificity, and positive and negative predictive values were calculated for CK-MB and cTnT in the first 24 h after presentation. Receiver operating characteristic (ROC) curves were also generated for these variables.

Results

Elevated cTnT levels (> 0.1 ng/ml) were recorded within the first 24 h in 99% of the 143 patients with AMI. Elevated cTnT levels within the first 24 h were also found in 14% of 1160 patients without AMI. Normal cTnT levels had a negative predictive value for AMI of 99.8%.

ROC curve analysis comparing the diagnostic accuracy of cTnT and CK-MB levels for the diagnosis of AMI revealed similar performance for both CK-MB and cTnT assay.

In the 1160 patients without AMI, 54 (5%) developed major cardiac events within 72 h of presentation. Amongst these patients elevated CK-MB levels within the first 24 h were found in 8% using the activity assay and in 3% using the mass assay. However 17 patients (31%) had elevated cTnT levels within 24 h.

There were 193 patients with discordant CK-MB and cTnT values. A total of 178 patients had elevated cTnT levels and normal CK-MB, of these, 13% had major cardiac events. Only 15 patients had normal cTnT levels and elevated CK-MB levels No patients developed major cardiac events within 72 h of presentation.

In 58 patients with renal failure, 43 (74%) had elevated cTnT levels, 10 (23%) had AMI, and 3 (7%) had a major cardiac event; therefore, cTnT levels are not useful for predicting major cardiac events during renal failure, as there is a 70% false positive rate.

Discussion

Unlike previous reports, this study exploring the diagnostic accuracy of cTnT was performed in the setting of a large unselected population with acute chest pain attending an emergency department. As in previous reports, the sensitivity of the assay for the diagnosis of AMI was excellent. In the 15% of patients with elevated cTnT levels but no evidence of AMI there was a relative risk of 2.4-3.6 for cardiac events. This was irrespective of the presence of ischemic changes on ECG. Earlier work has shown that compared to CK-MB, cTnT can identify those patients with UA who are at higher risk of AMI or death, thus cTnT levels may identify a lower level of myocardial injury than CK-MB. In this study 9% of patients had elevated cTnT levels but no evidence of clinical myocardial complications or ECG changes. It is difficult to define whether these patients represent false-positives or patients with subclinical myocardial injury. These patients probably include both true false-positives and those with low grade subclinical myocardial injury. Cardiac troponin I levels have also been shown to be as accurate as cTnT for the diagnosis of AMI. Further work is required to determine which marker is the most clinically useful and to investigate whether cTnT has an unacceptably high false-positive rate. The current data suggest that for cTnT a level of 0.2 ng/ml identifies patients who do not have AMI as determined by CK-MB, but who are at a high risk of cardiac complications.

References

1. Johnson PA, Goldman L, Sacks DB, et al: Cardiac troponin T as a marker of myocardial ischemia in patients seen at the emergency department for acute chest pain. Am Heart J. 1999, 137: 1137-1144.