

Cardiac Troponin Testing

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1/8

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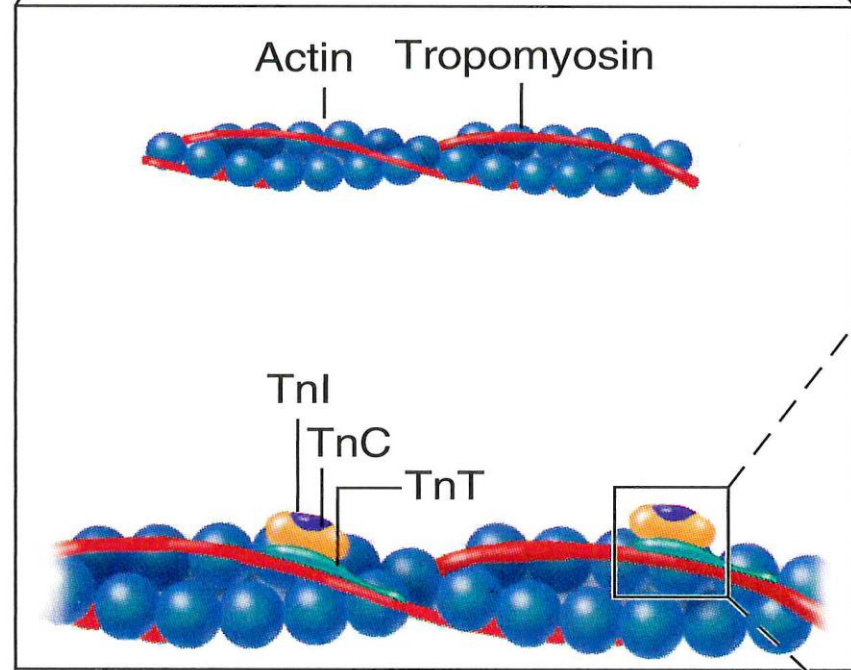
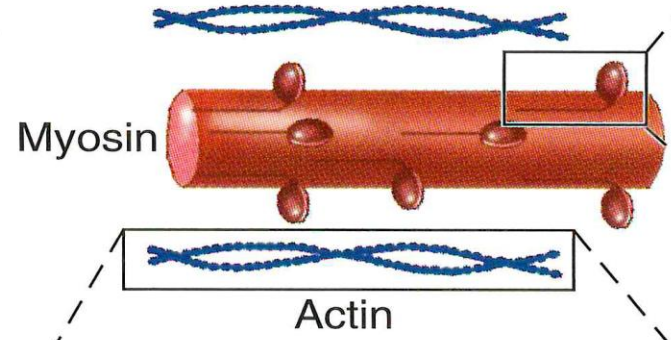
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1. No Disclosures
2. No conflict of interests

Overview

1. Cardiac troponin is part of a protein complex that regulates contraction of cardiac muscle. Troponin T and I are unique to cardiac myocytes.
2. Cardiac troponin testing consists of the measurement of cTnT or cTnI and used for confirming MI, or assessing prognosis. Elevated levels are associated with increased mortality in a wide range of patients.
3. Due to lack of standardization of assays, and different antibodies used in cTn assays, reference ranges vary among manufacturers.

A Actin and Myosin



C Thin filament

Acute Settings

ACC/AHA guidelines 2014

- A. Measure cTI or cTT in patients with suspected ACS at presentation and at 3-6 hours later
- B. Cardiac troponin testing in patients with kidney disease has reduced diagnostic accuracy. Serial changes in troponin greater than 20% are considered significant.

Non-acute settings

Elevated cTT levels are associated with increased mortality in dialysis patients, critically ill patients, and patients with pulmonary embolus

Overview

1. cTT or cTI are preferred biomarkers for suspected MI
2. Initial elevation may not be detectable for up to 6 hrs.
3. High sensitivity assays may have more false positives
4. cT after MI may estimate infarct size

General Information

1. Ischemia may lead to altered cell membrane integrity which leads to rapid depletion into cytoplasmic pool, followed by more sustained release into peripheral circulation
2. cTn can be measured by monoclonal or polyclonal antibodies
3. cTnI and cTnT provide similar information.

Recommended testing in ACS by ACC/AHA

1. Measure cTl or cTt at presentation and 3-6 hrs. later
2. Measure beyond 6 hrs. if initial cTn negative, or ECG changes, or the patient has high risk features
3. Tests which should not be used: CKMB, myoglobin, LDH

Definition of MI

1. cTn with greater than 1 value above the 99th percentile of upper reference level, plus at least one symptom of ischemia, or new ECG change, or new Q waves, or cardiac imaging reveals a new wall motion abnormality, or identification of thrombus by angiography or autopsy.
2. For procedure related MI occurring less than 48hrs later: if normal baseline cTn elevation greater than 5 times 99th percentile, or if baseline elevated cTn greater than 20% plus 1 of new ECG changes, or Q waves, angiographic findings consistent with flow limiting complication, cardiac imaging evidence of new loss of viable myocardium.
3. For post CABG: If normal baseline cTn elevation greater than 10x99th percentile of upper reference limit. If elevated baseline values, rise of cTn greater than 20% plus one additional finding of either new Q waves, angiographic findings, or new wall motion abnormality noted on cardiac imaging.

Fourth Universal Definition of MI ACC

August 2018

Type 1: Spontaneous MI caused by atherothrombotic CAD typically related to plaque rupture with rise of cTn with at least one value above the 99th percentile and least one:

- a. symptoms of acute myocardial ischemia
- b. new ECG changes
- c. new Q waves
- d. new regional wall motion abnormality
- e. identification of a coronary thrombus by cath. or by autopsy

Type 2: MI secondary to imbalance between myocardial oxygen supply and demand unrelated to plaque rupture and rise of cTn with at least one value above the 99th percentile and requiring at least one of the following:

- a. symptoms of acute myocardial ischemia
- b. new ECG changes
- c. new Q waves
- d. new regional wall motion abnormality

Typical cause included coronary spasm, coronary embolism, tachyarrhythmias, bradyarrhythmias, anemia, respiratory failure, shock, and HTN.

Type 3: MI resulting in death when biomarker values are unavailable.

Type 4: MI associated with PCI (type 4a), with stent thrombosis (type 4b), or with in-stent restenosis (type 4c)

Type 5: MI associated with CABG

The term "Myocardial infarction with non-obstructive coronary arteries" is used for patients with evidence of MI and no CAD (MINOCA)

The term non-myocardial infarction related elevated troponin is used for patients with elevated troponin and no other evidence of MI.

High Sensitivity cTn

1. HScTn may have greater sensitivity but lower specificity for diagnosis of MI than conventional cTn in patients with chest pain.
2. In analysis of 17 studies, sensitivity 88% vs. 74%, however specificity 82% vs. 94%.
3. HScTn may detect more cases of ACS among low to intermediate risk patients with chest pain.
4. Cutoff values for HScTn may be higher in patients over 70 y.o., or with GFR less than 60 cc/min
5. HScTn measured twice 1 hr. apart helps rule out MI in more patients with chest pain and no ST elevation.

cTn testing in patients with kidney disease

1. Baseline cTn in asymptomatic patients with CKD and without MI are often greater than 99th percentile. Therefore, diagnostic accuracy is reduced.
2. Chronic elevation may be due to decreased renal clearance, chronic injury from uremia, or microvascular ischemia.
3. Attention to serial changes is more important than a single increased level. Changes greater than 20% are considered important.
4. cTn has insufficient evidence to determine diagnostic performance for ACS in patients with CKD.

Other causes of elevated cTn in retrospective analysis of 615 patients

1. 53% had ACS
2. 11% had cardiac non-ischemic diagnoses (arrhythmias, myocarditis).
3. 8% had sepsis
4. 7% had pulmonary disease
5. 5% had neurologic disease (mainly ICH or CVA)
6. 5% had surgery (trauma, SBO, or GIB)
7. 2% had ESRD
8. 2% post cardiac arrest
9. 6% unknown

False positive elevation of cTn

Case reports due to antimurine antibodies which might develop after imaging techniques.
Estimated 0.05%.

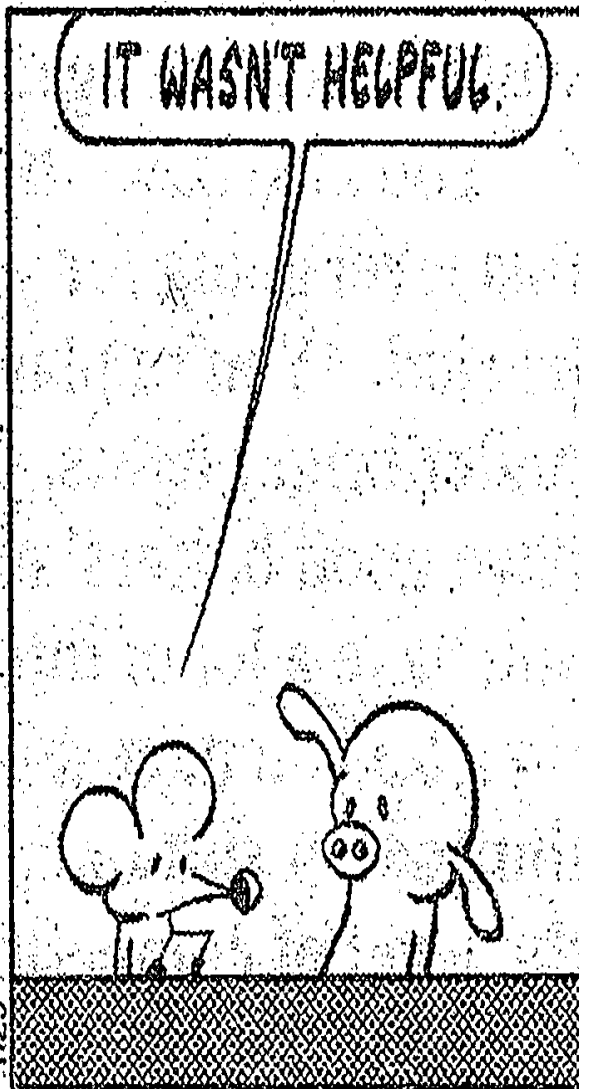
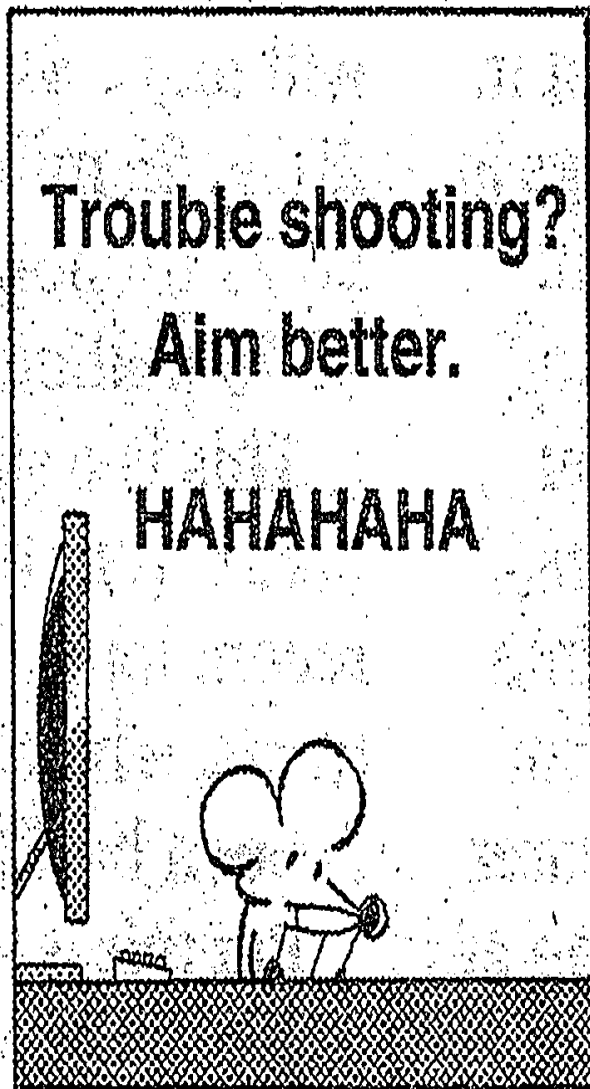
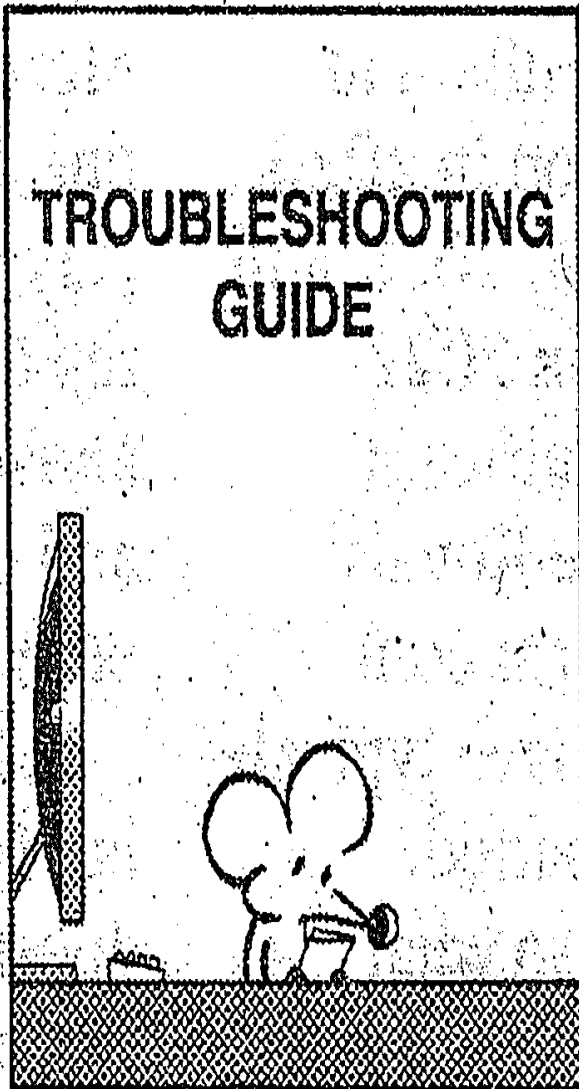
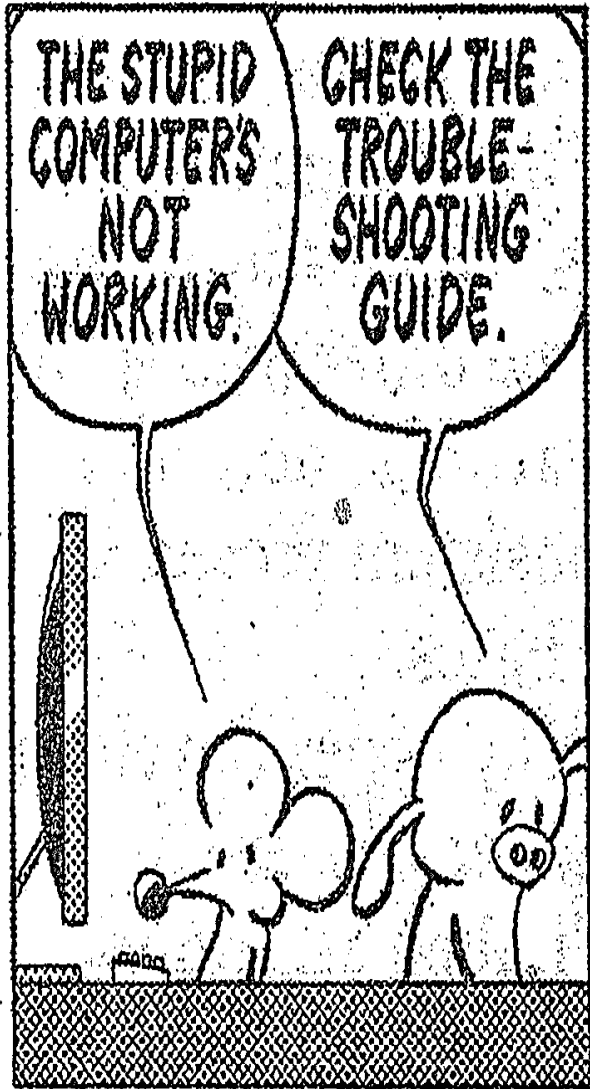
Using cTn Levels for Predicting Prognosis

1. cTn testing may allow safe discharge from emergency department for patients with chest pain and low risk for cardiac events.
2. In patients with ACS, any cTn elevation is associated with higher risk of in hospital mortality, and 30 day risk of MI or death even in patients with CKD.
3. Persistent minor elevations of cTn associated with increased mortality.
4. Elevated cTn associated with increased 1 year mortality after PCI.
5. Elevated cTn associated with increased in-hospital and post discharge mortality in patients with CHF.
6. Elevated cTn associated with increased risk of adverse vascular events and mortality in patients with cerebral ischemia
7. Elevated cTn associated with increased mortality in patients with ESRD.
8. cTn may predict mortality and length of stay in critically ill adults.
9. Elevated cTn associated with increased short term mortality in patients with pulmonary embolus.

Summary of Troponin Testing:

1. Assessing the patient with possible ACS requires evaluating 3 components: troponin measurement, history taking, and ECG interpretation.
2. Troponin values must be interpreted in the context of the clinical situation.
3. Interpreting troponin values often requires serial testing.
4. Although troponin is a specific protein of cardiac myocardium, elevated levels are seen in a variety of clinical situations, and usually indicate a worse prognosis.

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