Non-Ischemic Causes of Troponin Elevation:
Getting It Right
March 28, 2015
WHY discuss this...?

• Misconceptions about meaning of elevated troponin
• Validation of troponin when utilized properly
• Prognostic value (?) in certain circumstances

• Improper use or interpretation can be a very costly mistake for the hospital

• Troponin DOES matter
ACCF 2012 Expert Consensus Document on Practical Clinical Considerations in the Interpretation of Troponin Elevations

A Report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents

Developed in Collaboration With the American Association for Clinical Chemistry, American College of Chest Physicians, American College of Emergency Physicians, American Heart Association, and Society for Cardiovascular Angiography and Interventions

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Types of Myocardial Necrosis Events

Type 1: Ischemic myocardial necrosis secondary to plaque rupture (ACS)

Type 2: Ischemic myocardial necrosis not due to ACS (e.g., supply/demand mismatch, coronary spasm, embolism, ↑ or ↓ BP, anemia, arrhythmia)

Type 3: Sudden cardiac death

Type 4: Procedure related
   a) Secondary to PCI
   b) From stent thrombosis

Type 5: CABG related
Public Policy Implications Of The Adjustment Of The Mi Definition

Revision of the definition of MI has a number of implications for individuals as well as for society at large. A tentative or final diagnosis is the basis for advice about further diagnostic testing, lifestyle changes, treatment and prognosis for the patient. The aggregate of patients with a particular diagnosis is the basis for health care planning and policy and resource allocation.

One of the goals of good clinical practice is to reach a definitive and specific diagnosis, which is supported by current scientific knowledge. The approach to the definition of MI outlined in this document meets this goal. In general, the conceptual meaning of the term ‘myocardial infarction’ has not changed, although new, sensitive diagnostic methods have been developed to diagnose this entity. Thus, the diagnosis of acute MI is a clinical diagnosis based on patient symptoms, ECG changes, and highly sensitive biochemical markers, as well as information gleaned from various imaging techniques. It is important to characterize the type of MI as well as the extent of the infarct, residual LV function, and the severity of CAD and other risk factors, rather than merely making a diagnosis of MI. The information conveyed about the patient's prognosis and ability to work requires more than just the mere statement that the patient has suffered an MI. The many additional factors just mentioned are also required so that appropriate social, family, and employment decisions can be made. A number of risk scores have been developed to predict the prognosis after MI. The classification of the various other prognostic entities associated with MI should lead to a reconsideration of the clinical coding entities currently employed for patients with the myriad conditions that can lead to myocardial necrosis, with consequent elevation of biomarker values.

It should be appreciated that the definition of MI is not only important but also has implications for patients' psychological status, life insurance, professional career, as well as driving and pilots' licenses. The diagnosis is associated also with societal implications as to diagnosis-related coding, hospital reimbursement, public health statistics, sick leave...
Universal Definition of Myocardial Infarction

• Detect rise/fall of cardiac biomarker (preferably troponin) into/from the abnormal range with AT LEAST ONE OF THE FOLLOWING:

• Classic ischemic chest pain symptoms

• New ST changes or LBBB

• Pathologic Q waves

• Imaging showing new wall motion or new myocardial abnormality

• Plaque rupture/Thrombus on angiography
Another reminder --

- Troponin level rises within 4hrs of myocardial injury but stays elevated 7-10d
  - Great diagnostic for recent MI
  - Poor diagnostic for "re-infarct"
  - (CK-MB better here)
• 2007 National Academy of Clinical Biochemistry issued guidelines state:

• “In the presence of a clinical history suggesting of acute coronary syndrome, the following is considered indicative of myocardial necrosis consistent with myocardial infarction: Maximal concentration of cardiac troponin exceeding the 99th percentile of values (with optimal precision defined by total CV <10%) for a reference group on at least one occasion during the first 24 hours after the clinical event.”

• In order to meet this definition at NMMC, troponin elevation would need to exceed 0.34ng/ml (NMMC ULN currently 0.120ng/ml)
<table>
<thead>
<tr>
<th>Other Cardiac Causes of Troponinemia</th>
<th>Non-Cardiac Causes of Troponinemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest/Cardiac Trauma</td>
<td>Pulmonary Embolus</td>
</tr>
<tr>
<td>Cardiac Surgery/Recent Angioplasty</td>
<td>Pulmonary Hypertension</td>
</tr>
<tr>
<td>Cardioversion</td>
<td>Severe COPD/Asthma Attack</td>
</tr>
<tr>
<td>Acute on Chronic Heart Failure</td>
<td>Renal Failure</td>
</tr>
<tr>
<td>Aortic Dissection</td>
<td>Stroke and Subarachnoid Bleed</td>
</tr>
<tr>
<td>Tachyarrhythmias</td>
<td>Sepsis</td>
</tr>
<tr>
<td>Bradyarrhythmia/Heart Block</td>
<td>Burns</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>Extreme Exertion</td>
</tr>
<tr>
<td>Pericarditis/Myocarditis</td>
<td>Cardiotoxic Drugs</td>
</tr>
<tr>
<td>Severe Aortic Valve Disease</td>
<td></td>
</tr>
</tbody>
</table>
Pulmonary Embolus

- 2007 meta-analysis: median rate of troponin elevation was 39%
- Troponin elevation associations in PE:
  - short-term (<30 day) all-cause mortality
  - highly associated with fatal PE
  - non-fatal complications

- Pulm vascular obstruction - vasoconstriction - sudden
  PVR and PA pressure increase - RV afterload
- RV dysfunction = increased mortality in PE
Chronic Kidney Disease

- Troponin elevation likely not caused solely by reduced renal clearance (Intact troponin = large molecules)
- Elimination of Trop I similar in normal renal fxn and ESRD
- Associations of Troponin with CKD:
  - All-cause mortality (RR 2.64)
  - Cardiac Death (RR 2.55)

- NACB Laboratory Medicine Practice Guidelines:
  - Rely on dynamic change in troponin >20% in 6-9hr range

- FDA approved Trop T for identifying CKD pts with high mortality risk
Sepsis

• Myocardial dysfunction common
• Meta-analysis of 10 sepsis studies - median 62% with troponin elevation
  • 5 studies found significant association between troponin + and death
• Elevated troponin is a potential marker for LV dysfunction

• Routine troponin testing in sepsis is NOT recommended
Chemotherapy-Associated Cardiotoxicity

• Expert panel: troponin is the preferred biomarker to detect drug-induced cardiac injury

• Facts:
  • *Trop (+), any level, any time = increased risk of permanent/more severe LV dysfunction*
  • Enalapril treatment addition...
  • *Trop (-) in pts with early LV dysfunction tend toward better/full LV recovery*

• Known: Useful in detecting toxicity and severity

• Unknown: Predicting long-term CV mortality
### Other Cardiac Causes of Troponinemia

- Chest/Cardiac Trauma
- Cardiac Surgery/Recent Angioplasty
- Cardioversion
- Acute on Chronic Heart Failure
- Aortic Dissection
- Tachyarrhythmias
- Bradyarrhythmia/Heart Block
- Endocarditis
- Pericarditis/Myocarditis
- Severe Aortic Valve Disease

### Non-Cardiac Causes of Troponinemia

- Pulmonary Embolus
- Pulmonary Hypertension
- Severe COPD/Asthma Attack
- Renal Failure
- Stroke and Subarachnoid Bleed
- Sepsis
- Burns
- Extreme Exertion
- Cardiotoxic Drugs
“When troponin was a lousy assay, it was a great test, but now that it’s become a great assay, it’s getting to be a lousy test”
Readmission Reduction Program

Background

Section 3025 of the Affordable Care Act added section 1886(q) to the Social Security Act establishing the Hospital Readmissions Reduction Program, which requires CMS to reduce payments to IPPS hospitals with excess readmissions, effective for discharges beginning on October 1, 2012. The regulations that implement this provision are in subpart I of 42 CFR part 412 (§412.150 through §412.154).

News on the Hospital Readmissions Reduction Program

CMS has posted the FY 2015 IPPS/LTCH PPS final rule. In the FY 2015 IPPS Final Rule, CMS has made refinements to the readmissions measures. CMS is finalizing to include two additional readmissions measures, COPD and THA/TKA in the calculation of a hospital’s readmissions payment adjustment factor. For more information on these payment-related policies, please refer to the FY 2015 IPPS Final Rule in the Downloads section below.

Readmission Measures

In the FY 2012 IPPS final rule, CMS finalized the following policies with regard to the readmission measures under the Hospital Readmissions Reduction Program:

- Defined readmission as an admission to a subsection(d) hospital within 30 days of a discharge from the same or another subsection(d) hospital;
- Adopted readmission measures for the applicable conditions of Acute Myocardial Infarction (AMI), Heart Failure (HF) and Pneumonia (PN);
Thank You

Questions?