Undetectable High Sensitivity Cardiac Troponin T Level in the Emergency Department and Risk of Myocardial Infarction

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Late Breaking Clinical Trial, ACC.14, Washington
Disclosure information

- No conflicts of interest.
Background

- Chest pain is one of the most common reasons for seeking medical attention in Emergency Departments (ED) with an estimated 15–20 million visits each year in Europe and the U.S.

- Only 10-20% of patients hospitalized for chest pain are diagnosed with MI

- Unnecessary admissions are a burden for health care providers
Background

- The cornerstone of diagnosing MI is the ECG and biomarkers indicating myocardial damage, commonly cardiac troponins.

- Recently high-sensitivity cardiac troponin assays have been introduced in clinical practice.

- They are able to detect minimally increased levels of troponins in the blood several hours before older generations of troponin assays.

- Repeated measurements of hs-cTnT may not be necessary.
Hypothesis

- All patients with chest pain, who have an undetectable high-sensitivity cardiac troponin T (< 5 ng/l), and an ECG without signs of ischemia, may be discharged directly from the emergency department (ED), since their risk of MI within 30 days is minimal.
Setting and Study population

- All patients, > 25 years of age, who came to the emergency department at the Karolinska University Hospital in Stockholm, Sweden,

- with a principal complaint of chest pain, and at least one hs-cTnT level analyzed,

- during December 10, 2010 to December 31, 2012 were included
Methods

- High sensitivity cardiac troponin T (hs-cTnT)
- Elecsys 2010 system (Roche Diagnostics GmbH, Mannheim, Germany)
- Detection limit of 2 ng/l,
- 99th-percentile cutoff point of 14 ng/l
- Coefficient of variation is <10% at 13 ng/l
Methods

Exposure

- A first hs-cTnT < 5 ng/L (undetectable) in the ED, in combination with an ECG without significant ST-elevation or depression

- All ECGs for patients with undetectable hs-cTnT and MI were evaluated by two external senior cardiologists blinded for the study protocol
Methods

Outcome

- Primary outcome: Fatal or non-fatal MI within 30 days

- Secondary outcomes:
  - MI at 180, and 365 days
  - all-cause mortality at 30, 180 and 365 days
Study population

330 000 ED visits / 2 years

Study period
2010 - 2012

Age > 25, chest pain,
hs-cTnT analyzed

n=14 636
4,4%

Hs-cTnT

< 5 ng/L
61%

Admitted
21%

Discharged
79%

5 – 14 ng/L
21%

Admitted
44%

Discharged
56%

> 14 ng/L
18%

Admitted
82%

Discharged
18%
## Results

### Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>All patients</th>
<th>&lt;5</th>
<th>5-14</th>
<th>&gt;14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>14 636</td>
<td>8 907</td>
<td>3 150</td>
<td>2 579</td>
</tr>
<tr>
<td>Percent of cohort</td>
<td>100</td>
<td>61</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Age (y)</td>
<td>55</td>
<td>47</td>
<td>63</td>
<td>71</td>
</tr>
<tr>
<td>Female sex, (%)</td>
<td>48</td>
<td>53</td>
<td>41</td>
<td>37</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>10</td>
<td>5</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>Prior MI (%)</td>
<td>9</td>
<td>4</td>
<td>14</td>
<td>39</td>
</tr>
<tr>
<td>Prior Stroke (%)</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Prior CHF (%)</td>
<td>6</td>
<td>1</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>
Patients with undetectable hs-cTnT and MI within 30 d.

- **MI**
  - n=39
- **ECG changes**
  - n=24
- **No ECG changes**
  - n=15
  - **NSTEMI**
    - n=11
  - **STEMI**
    - n=4
  - **Maximum hs-cTnT**
    - < 30 ng/l, n=6
    - 40–100 ng/l, n=3
    - >100 ng/l, n=2
  - **Coronary Angiography**
    - n=11
Timing of hs-cTnT level analysis in MI patients with undetectable hs-cTnT and ECG without ischemia

- The first hs-cTnT level was measured within 2 h of the onset of symptoms in 11 (73%) patients,

- between 2 to 3 hours in 2 (13%) patients, and

- >3 h after the onset of symptoms in 2 (13%) patients.
## Risk of Myocardial Infarction

<table>
<thead>
<tr>
<th>High-Sensitivity Cardiac Troponin T level (ng/L)</th>
<th>&lt;5</th>
<th>5-14</th>
<th>&gt;14</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Myocardial infarction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>30 days</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of events</td>
<td>15</td>
<td>97</td>
<td>676</td>
</tr>
<tr>
<td>Negative pred. val.</td>
<td><strong>99,8 (99,7-99,9)</strong></td>
<td>96,9 (96,3-97,5)</td>
<td>73,8 (72,1-75,5)</td>
</tr>
<tr>
<td><strong>365 days</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of events</td>
<td>54</td>
<td>134</td>
<td>753</td>
</tr>
<tr>
<td>Negative pred. val.</td>
<td><strong>99,4 (99,2-99,5)</strong></td>
<td>95,7 (95,0-96,5)</td>
<td>70,8 (69,0-72,6)</td>
</tr>
</tbody>
</table>

Nadia Bandstein, M.D.
Risk of death in patients with undetectable hs-cTnT

- There were 2 deaths within 30 days
- The NPV for death was 100% (99.9-100)
- At 1 year of follow-up there were 38 deaths, of whom 32 were caused by cancer and 2 were cardiovascular
Discharge diagnosis in patients with undetectable hs-cTnT who were admitted

- 77% of admitted patients were discharged the same or the next day,

- In patients with undetectable hs-cTnT 50% had a discharge diagnosis of unspecific chest pain,

- the second most common diagnosis was atrial fibrillation (6%),

- the third most common diagnosis was angina pectoris (5%)
Clinical Implications

- Unnecessary admissions may be avoided
- May help diminish overcrowding of the ED
- Saving time for the patient and the doctor
Conclusion

- A first hs-cTnT level of <5 ng/l and no signs of ischemia on ECG ruled out MI with nearly 100% accuracy regardless of prior disease, timing of measurement of the hs-cTnT level, age, sex, or other risk factors for MI,

- The negative predictive value for death associated with an undetectable hs-cTnT and an ECG without signs of ischemia was 100%,

- Only in our hospital this simple strategy may prevent 500 to 1000 unnecessary hospitalizations per year
Thank you ACC.14