Clinical prediction guide

A simple risk index accurately predicted mortality in patients with ST elevation myocardial infarction


QUESTION: Can a simple risk index based on 3 routinely collected variables accurately predict mortality in patients with ST elevation myocardial infarction (MI)?

Design

Patient data from 3 multicentre randomised controlled trials were used for the development and validation of a risk index (Intravenous nPA for the Treatment of Infarcting Myocardium Early [InTIME II] Trial; and Thrombolysis and Thrombin Inhibition in Myocardial Infarction [TIMI] 9A and B trials).

Setting

>800 hospitals worldwide from the InTIME II trial for index development and 150 centres in the US, UK, Canada, Israel, and Germany* from the TIMI 9A and B trials for index validation.

Patients

The development set comprised data from 13,253 patients who had ST elevation MI and were enrolled within 6 hours of symptom onset, and who did not have a history of cerebrovascular disease, systolic blood pressure (SBP) >180 mm Hg, diastolic blood pressure (DBP) >110 mm Hg, cardiogenic shock, or increased risk of severe bleeding. The validation set comprised data from 3659 patients who had ST elevation MI and were assessed by a physician as suitable for thrombolytic therapy. Both the development and validation sets excluded a small number of patients with a heart rate <50 beats/minute or >150 beats/minute.

Description of prediction guide

Based on the observed relations between age, heart rate, and SBP and 30 day mortality, the following equation was constructed as the risk index:

\[
\text{Risk index} = \frac{(\text{heart rate} \times \left(\frac{\text{age}}{10}\right)^2)}{\text{SBP}}.
\]

Main outcome measures

30 day mortality predicted by the risk index. Other outcomes included 24 hour and in hospital mortality, and heart failure.

Main results

In the derivation set, the risk index strongly predicted mortality at 30 days (area under the receiver operating characteristic curve \(c=0.78\)). When index scores were categorised as quintiles, the risk index showed a more than 20 fold gradient of increasing mortality risk \((c=0.76)\) (table). The risk index was a robust predictor of mortality within 24 hours \((c=0.81)\), hospital discharge \((c=0.79)\), and development of new or worsening heart failure at 24 hours \((c=0.68)\) and at discharge \((c=0.69)\).

In the validation set, stratification of index scores into quintiles showed a similar gradient of mortality risk over 30 days and strongly predicted risk \((c=0.77)\). The risk index was a strong predictor of mortality at 24 hours and of heart failure.

Conclusion

In patients presenting with ST elevation myocardial infarction and a heart rate of 50–150 beats/minute, a simple risk index based on age, heart rate, and systolic blood pressure predicted mortality at 30 days.*


Risk index scores (quintiles) and mortality risks for patients with ST elevation myocardial infarction (derivation data set)

<table>
<thead>
<tr>
<th>Risk index score</th>
<th>24 hours</th>
<th>In hospital</th>
<th>30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;12.5</td>
<td>0.2%</td>
<td>0.6%</td>
<td>0.8%</td>
</tr>
<tr>
<td>&gt;12.5 to 17.5</td>
<td>0.4%</td>
<td>1.5%</td>
<td>1.9%</td>
</tr>
<tr>
<td>&gt;17.5 to 22.5</td>
<td>1.0%</td>
<td>3.1%</td>
<td>3.3%</td>
</tr>
<tr>
<td>&gt;22.5 to 30</td>
<td>2.4%</td>
<td>6.5%</td>
<td>7.3%</td>
</tr>
<tr>
<td>&gt;30</td>
<td>6.9%</td>
<td>15.8%</td>
<td>17.4%</td>
</tr>
</tbody>
</table>

\(\text{c} = \text{characteristic curve}\)

COMMENTARY

Morrow et al describe a method to predict mortality in patients with an ST elevated MI by performing a simple calculation based on heart rate, age, and SBP. The calculation is relatively simple, and the variables are collected as part of the routine assessment of patients being evaluated for acute coronary syndromes, regardless of setting. A study strength is the use of a large pre-existing data set from >800 hospitals worldwide.

Study patients had an ST elevated MI and were eligible for thrombolytic treatment. However, some high risk patients, such as those who had extreme heart rates (<50 or >150 beats/min), were ineligible for thrombolytic treatment, or were having a non-ST elevated MI, were excluded from the study. Therefore, nurses caring for patients with acute coronary syndromes should be careful about generalising the findings to all patients with MI.

In patients presenting with ST elevation MI and were eligible for thrombolytic treatment. However, some high risk patients, such as those who had extreme heart rates (<50 or >150 beats/min), were ineligible for thrombolytic treatment, or were having a non-ST elevated MI, were excluded from the study. Therefore, nurses caring for patients with acute coronary syndromes should be careful about generalising the findings to all patients with MI.

The \(c\) statistic reported by the authors can be interpreted as the proportion of time the risk index accurately identifies a person who actually goes on to have the adverse outcome compared with one who does not. The \(c\) statistic of 0.78, therefore, means that the risk index accurately predicted 30 day mortality 78% of the time. Although this is better than the odds when tossing a coin (ie, 50–50 chance), the score is by no means infallible. Clinicians should be cautious in using it to determine whether to treat a patient or whether aggressive or conservative care measures are indicated.

Because of the ease of performing the calculation, it can be quickly learned by ambulance personnel and triage nurses. It might be helpful in routing high risk patients to major tertiary care centres where techniques can be delivered to minimise myocardial damage. But, clinicians who treat patients in pre-hospital settings, such as physicians’ offices or ambulances, should not use this calculation alone to determine which patients are at particularly high risk for a cardiac related death. It may lead to a perception that those identified at lower or moderate risk should be treated less urgently or less aggressively. The risk index should be used on appropriate patients to alert clinicians to patients who are at higher risk than they might think.