Coronary CT vs Stress Test vs Crystal Ball...

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• Brevity
• Levity
• Repetition
Do a stress test old chap
Do a stress test old chap

• Sensitivity = 70%
• Specificity = 78%
Crystal ball

Google (incl. scholar) search: crystal ball predict heart disease

• The crystal ball heart test rarely used: BNP
  • BNP, + Elevated fibrinogen, hsCRP, a CT heart scan and homocysteine are known risk factors

• Treatment Vitamin E including the eight tocotrienol esp. alpha, beta, gamma, delta…

• You can take staring into that proverbial crystal ball to the next level with advanced cardiovascular serum testing to identify 15 additional early risk factors for cardiovascular disease.

• Each test is simple, takes less than 30 minutes, and is performed while you kick back in a zero gravity chair.

www.functionalmedicineuniversity.com
Which test

- We must consider our clinical assessment and our pre test probability
- UK NICE 95 guidelines
- 393 pages into 15 minutes.
- 1. Acute chest pain – look for STEMI etc
- 2. What to do after the 8/12 hour trop
- 2. What to do for Suspected stable angina
  – The latter two are essentially the same.
Value bet - new onset ?acute coronary syndrome

acknowledgement to Dr Lawton’s logical thinking

• Pain in chest > 15’ → arms, back, jaw
• Assoc nausea + vomiting, sweating, SOB
• Associated haemodynamic instability
• New onset, increased pattern, > 15 mins
  – DO NOT USE GTN response
    • Don’t use gender/ethnicity
  – DO use ECG and troponin
  – DO use delayed ECG and troponin
• Then… if all normal,
• treat as suspected stable angina
If suspected stable angina...
Response to GTN, worse on exertion, relief with rest.
Then what
Pre test probability
Clinical skills still needed (yay)

• Is pain worse on exertion, relief with rest, relief with GTN?
  – Typical angina = all three
  – Non typical angina = 2/3
  – Non anginal pain = 0 or 1

• Add age, gender, risk factors…

• Less likely if continuous very prolonged, unrelated to activity, brought on by breathing in, assoc dizziness, palpitations, tingling or difficulty swallowing
Table 1 Percentage of people estimated to have coronary artery disease according to typicality of symptoms, age, sex and risk factors

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Non-anginal chest pain</th>
<th>Atypical angina</th>
<th>Typical angina</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>35</td>
<td>3 Lo</td>
<td>35 Hi</td>
<td>8 Lo</td>
</tr>
<tr>
<td>45</td>
<td>9 Lo</td>
<td>47 Hi</td>
<td>21 Lo</td>
</tr>
<tr>
<td>55</td>
<td>23 Lo</td>
<td>59 Hi</td>
<td>45 Lo</td>
</tr>
<tr>
<td>65</td>
<td>49 Lo</td>
<td>69 Hi</td>
<td>71 Lo</td>
</tr>
</tbody>
</table>

For men older than 70 with atypical or typical symptoms, assume an estimate > 90%.
For women older than 70, assume an estimate of 61–90% EXCEPT women at high risk AND with typical symptoms where a risk of > 90% should be assumed.

Values are per cent of people at each mid-decade age with significant coronary artery disease (CAD).

Hi = High risk = diabetes, smoking and hyperlipidaemia (total cholesterol > 6.47 mmol/litre).
Lo = Low risk = none of these three.

The shaded area represents people with symptoms of non-anginal chest pain, who would not be investigated for stable angina routinely.

Note:
These results are likely to overestimate CAD in primary care populations.
If there are resting ECG ST-T changes or Q waves, the likelihood of CAD is higher in each cell of the table.
In patients without confirmed CAD, stable angina clinically not diagnosed or excluded

- If estimated likelihood of CAD is
  - 61-90% - invasive coronary angiography
  - 30-60% - functional imaging
  - 10-29% - calcium scoring CT
    - 0 – consider other causes
    - 1-400 – offer CT coronary angiography
    - > 400 offer invasive coronary angiography
- < 10% - consider other causes, e.g. anaemia or HOCM or others…
Do test results give you answers?

• So what if I let you use the same test, but the performance varied
  – Based on your assessment
  – In different populations
  – On the different machines
  – Based on the different reporters

• I know, you want some cold hard facts, some statistics
  – Not lies, damn lies and statistics… ok
Do I trust the statistics?
<table>
<thead>
<tr>
<th></th>
<th>Has the disease</th>
<th>Does not have the disease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Score:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Positive</strong></td>
<td>True Positives</td>
<td>False Positives</td>
</tr>
<tr>
<td></td>
<td>(TP)</td>
<td>(FP)</td>
</tr>
<tr>
<td></td>
<td><em>a</em></td>
<td><em>b</em></td>
</tr>
<tr>
<td><strong>Negative</strong></td>
<td>False Negatives</td>
<td>True Negatives</td>
</tr>
<tr>
<td></td>
<td>(FN)</td>
<td>(TN)</td>
</tr>
<tr>
<td></td>
<td><em>c</em></td>
<td><em>d</em></td>
</tr>
</tbody>
</table>

**Positive Predictive Value (PPV)**

\[ PPV = \frac{TP}{TP + FP} \]

**Negative Predictive Value (NPV)**

\[ NPV = \frac{TN}{TN + FN} \]

**Sensitivity**

\[ Sensitivity = \frac{TP}{TP + FN} \]

**Specificity**

\[ Specificity = \frac{TN}{TN + FP} \]

**Or,**

\[ Sensitivity = \frac{a}{a + c} \]

\[ Specificity = \frac{d}{d + b} \]
Sensitivity and Specificity

- Sensitivity is the probability that a test will indicate 'disease' among those with the disease:
- Specificity is the fraction of those without disease who will have a negative test result:

* Sensitivity and specificity are characteristics of the test.
* The population does not affect the results.
Positive predictive value or negative predictive value

• Clinicians – what does test result mean.

• *Positive and negative predictive values are influenced by the prevalence* of disease in the population that is being tested.

• If we test in a high prevalence setting, it is more likely that persons who test positive truly have disease than if the test is performed in a population with low prevalence.
Choose wisely

• Thanks Will
Coronary CT vs Angiogram
To detect >50% stenosis

- Sensitivity is 98% and
- Specificity is 88%

- Negative predictive values – 96-100%
- Positive predictive values – 93%
- >45 single centre studies
Is this performance consistent?

- Sensitivity 98%
- Specificity 88%
- The pre test probability was 60%
- To produce a NPV of 96%
- And a PPV of 93%
Is this performance consistent?

- Sensitivity 98%
- Specificity 88%
- The pre test probability was 10%
- To produce a NPV of 99.7%
- And a PPV of 47%
Is this performance consistent?

- Sensitivity 98%
- Specificity 88%
- The pre test probability was 90%
- To produce a NPV of 83%
- And a PPV of 99%
Then what do we make of this

- Negative predictive value of 96-100%, if the population prevalence is 60%
- Yet
- Recommended for 10-29%
- If it was 10%, NPV increases to 99.7%
- So that looks like a reasonable outcome
  - Calcium scores – no MBS item
  - CT coronary
Simple?

- There are some conflicting papers published
- Increased tests costs - reference
- Reduced number of tests
- Some patients missed by tests in certain groups
Exercise stress tests - poor cousins
70% sensitivity, 78% specificity
So Why Do An Exercise ECG?

- NICE Say: "Do not use an exercise ECG to diagnose or exclude stable CAD"
  But ... nothing stops us from choosing to use it once we've made a clinical diagnosis, for some prognostic information.
- Exercise Treadmill Test are useful to
  - Assess or trigger symptoms (arrhythmias, valvular heart disease)
  - Assess exercise capacity
  - Provide prognostic information
Useful resources

• http://www.ecgclass.co.uk/2012/11/the-nice-chest-pain-guidelines.html