What’s the point of ST elevation?
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Objective: The magnitude of ST elevation is a key piece of information in the decision to thrombolyse in acute myocardial infarction. The ability of clinicians to reliably identify ST elevation has not been previously assessed. This study sought to determine the variability in assessment of ST elevation in a group of doctors who commonly prescribe thrombolysis.

Methods: The study was conducted in three large teaching hospitals in Manchester, England. A convenience sample of 63 SHOs and SpRs from emergency and general medicine were recruited. Each was shown three sample ECG complexes. They were asked to identify and quantify the degree of ST elevation. They then indicated the points on the ECG from which they measured ST elevation.

Results: ST elevation was not identified in 12% of cases. Doctors used a wide variety of points on the ST segment to assess elevation, this resulted in a wide variation in the observed magnitude of ST elevation.

Conclusion: No guidance exists on where exactly ST elevation should be measured. This study shows a wide variation in practice. Protocol led thrombolysis decision pathways may be compromised by these findings.

The timing of thrombolysis in acute myocardial infarction (AMI) is important because the earlier it is given the more lives are saved.1 If thrombolysis times are to be optimised, the decision must be made as soon as possible after the first doctor-patient contact. However, junior doctors are usually the first medical staff to see the patient with chest pain. Consequently thrombolysis decisions are typically made at a junior level. Strict guidelines are used in many hospitals to help identify those patients suitable for thrombolysis. An essential question in the decision to thrombolyse is the detection and quantification of ST elevation2 as those patients with ST elevation have been shown to most benefit from thrombolysis.3

In early 1999 an internal audit of thrombolysis revealed a number of patients in whom AMI had been incorrectly diagnosed. It was postulated that one reason for this may be the variation in assessment of ST elevation among junior doctors.

The aim of this study was to determine if doctors who currently prescribe thrombolysis vary in their measurement techniques and quantification of ST elevation using sample ECG complexes.

METHODS
The study was conducted at three Manchester teaching hospitals. Doctors from acute medicine or accident and emergency were recruited. An A&E SpR in each hospital recruited a convenience sample of approximately 20 doctors. We chose junior doctors as it is at this grade that thrombolysis decisions are usually made.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Number of ECGs in which ST elevation was not identified</th>
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<tbody>
<tr>
<td>Total number missed (%)</td>
<td></td>
</tr>
<tr>
<td>ECG 1</td>
<td>4 (6)</td>
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<tr>
<td>ECG 2</td>
<td>5 (8)</td>
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<tr>
<td>ECG 3</td>
<td>14 (22)</td>
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<tr>
<td>Overall</td>
<td>23 (12)</td>
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Each doctor was shown a single enlarged complex from three different ECGs. The complexes were selected by the principal authors to demonstrate different patterns of ST elevation taken from patients with myocardial infarctions.

Participants were asked (a) If there was any ST elevation present, (b) How much ST elevation was present (if they considered any to be present), (c) They were then asked to mark
on the ECG where they took the measurements from and to in
deciding if ST elevation was present.

Ethical committee approval was not sought for this study as
it did not involve patients or patient records. As this was
essentially a descriptive study, no power study was performed.

RESULTS

Eleven (17%) specialist registrars (or senior SHOs) and 52
(83%) SHOs were sampled. Thirty one were from A&E medi-
cine and 32 from general medicine.

Ability to identify ST elevation (table 1)

Overall ST elevation was not identified in 23 (12%) of cases.
This proportion was highest for ECG 3.

ECG 1 (fig 1)

Eighteen (29%) of doctors measured ST segment elevation at
the J point, a further 27 doctors (43%) measured up to 1 mm
past the J point. The remaining 18 doctors (29%) measured
beyond this with six (9.5%) using the peak of the T wave. The
observed magnitude of ST elevation was wide with 43% of
doctors identifying more than 3 mm of ST elevation (the J
point lies at 3–3.5 mm on the ECG).

ECG 2 (fig 2)

Thirty five (61%) of measurements were made at the J point.
Fourteen measurements (18%) were made at 80 msec or
beyond the J point. Three (5%) used the peak of the T wave. ST
elevation was identified at more 2.5 mm on 28 (48%) ECGs
(the J point lies at just under 2 mm on the ECG). One doctor
identified ST elevation as 1 mm only.

ECG 3 (fig 3)

Eight (13%) of the measurements were made at the J point. A
further 26 doctors measured within 1 mm of the J point. The
J point lies at 1.6 mm or more of ST elevation. Thirty one
(47%) of doctors measured more than 2 mm of ST elevation.

DISCUSSION

We have shown that there is a high failure rate to identify ST
elevation in doctors currently deciding on the prescription of
thrombolysis. The interobserver variability of ST segment
interpretation has been identified recently by Tandberg
et al...
Our sample is typical of doctors who currently decide on thrombolysis. If the aim of early thrombolysis in AMI is to be achieved it is important that clear instructions are given to junior staff with regard to ST measurement. This study cannot determine the correct point of measurement, further work is required.

In conclusion, there is no accepted point at which ST segment elevation should be measured in AMI. There is wide variation in the point at which junior doctors measure ST elevation. This results in a significant variation in the observed variation in the point at which junior doctors measure ST elevation. Such variation has the potential to result in an inappropriate prescription, or a failure to prescribe thrombolysis.

Contributors
Simon Carley participated in the design the study, discussed core ideas, collated and analysed the data and is the guarantor of the paper. Roger Gamon participated in the original study hypothesis, discussed core ideas, helped design the study and helped write the paper. Peter Driscoll participated in the original study hypothesis, discussed core ideas, helped design the study and helped write the paper. Ged Brown and Paul Wallman discussed core ideas, collected data and helped write the paper.

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