How to give thrombolysis in acute myocardial infarction

Original article: Michael Tam

In the major urban hospitals, there will be little place for thrombolysis in acute STEMI (ST-elevation myocardial infarction). Primary PCI (percutaneous coronary intervention) is clearly the treatment of choice (1).

However, if you work in a rural or remote setting where the local hospital does not have a cardiologist who can offer primary PCI, then thrombolysis makes a difference. The 30-day mortality in newly diagnosed acute coronary syndrome from 1987-2000 decreased by 47%. This has been attributed to aspirin and coronary revascularisation procedures (e.g., thrombolysis and PCI) (2).

There are many thrombolytic agents that have been released since streptokinase. In this article, I discuss the use of tenecteplase (Metalyse) as it is the one I have most experience with and easiest to use.

Assuming that the diagnosis of an acute coronary syndrome has been made or is highly suspected from the history and examination:

**Step One: Initial stabilisation**

Remember your "ABCs" of emergency management (3):

**Position:**
- Comfortably;
- in a monitored bed.

**Airway:**
- Keep patent.

**Breathing:**
- Administer high flow (i.e., > 6 L/min) via a Hudson mask or non-rebreather mask;
- assess respiratory rate and effort (if inadequate, assist with ventilation, e.g., bag-valve-mask with oxygen);
- measure SaO2 (finger probe).

**Circulation:**
- Measure pulse rate, blood pressure (both arms if thoracic aortic dissection is suspected) and capillary refill;
• attach cardiac monitoring equipment and correct any immediate lifethreatening arrhythmia;
• if BP is adequate, give sublingual glyceryl trinitrate (Anginine);
• insert intravenous cannulae x 2;
• at the same time, take bloods (FBC, UEC, troponin, coags, BSL, lipid profile and group and hold).

Perform a 12-lead ECG

Disability:

• Measure Glasgow Coma Score (GCS); if less than or equal to 8 then consider endotracheal intubation to protect the airway.

Other tests:

• Chest x-ray: useful whether aortic dissection or pneumothorax are possible diagnoses.

Step Two: Emergency treatments for acute myocardial infarction

Aspirin:

• Give one tablet of chewable or dissolvable aspirin (100-300 mg);
• would probably have already been given by the ambulance officers or the triage/ED nurses, but always check;
• use clopidogrel (75 mg) if aspirin allergy or intolerance.

Glyceryl trinitrate:

• Usually, one or more sublingual tablets of sublingual glyceryl trinitrate would have been given prior to their presentation to the ED;
• give a tablet sublingually (600 mg) every 5 minutes as needed for pain up to three tablets assuming blood pressure is maintained;
• use a half tablet for the elderly;
• consider an intravenous infusion of nitrates in severe hypertension.

Morphine:

• Give in 2-5 mg intravenous aliquots every 5 minutes until pain controlled.

Step Three: Indication for thrombolysis

• Ischaemic chest pain > 30 minutes duration
• Less than 12 hours from the onset of pain
• ECG changes:
  • new ST elevation of at least 2 mm in two consecutive chest leads;
  • or ST elevation of at least 1 mm in two consecutive limb leads;
The benefit from thrombolysis is greatest when it is given early, preferably within an hour of onset of the chest pain and preferably within 4. Although there is some benefit up to 12 hours from an infarct, it becomes relatively small.

**Step Four: Consider contraindications**

Thrombolytic therapy is associated naturally with a substantially increased risk of bleeding. The following is a non-exhaustive list of contraindications to thrombolytic therapy (4):

- Patients with current concomitant oral anticoagulant therapy (INR > 1.3);
- any history of central nervous system damage (i.e. neoplasm, aneurysm, intracranial or spinal surgery);
- known haemorrhagic diathesis;
- severe uncontrolled hypertension, i.e. systolic BP > 180 mmHg and/or diastolic BP > 110 mmHg;
- major surgery, biopsy of a parenchymal organ in the past two months;
- prolonged traumatic cardiopulmonary resuscitation within the past two weeks;
- severe hepatic dysfunction;
- diabetic haemorrhagic retinopathy;
- active peptic ulceration, during the last three months;
- arterial aneurysm or AV malformation;
- previous stroke or other cerebrovascular disease;
- acute pericarditis;
- subacute bacterial endocarditis;
- acute pancreatitis.

**Step Five: Informed consent**

Bleeding to death, is a nasty way to die. Needless to say, patients and their family members do no expect death from exsanguination after going to hospital with a heart attack. The following figures are for tenecteplase (Metalyse) (4) (5):

**Risks**

- All bleeding complications: 26%
- Major bleed: 5%
- Intracranial haemorrhage: 1%
I have seen a number of bleeding complications from the use of thrombolysis. The "disasters" invariably occur where the consent taken was questionable (i.e., from an elderly and possibly slightly demented spouse) or from people whose English is not their first language and an interpreter was not used.

Step Six: Give heparin bolus

Prior to giving tenecteplase:

**heparin sodium 5000 units intravenously as a bolus**

Step Seven: Calculate dose of tenecteplase

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>tenecteplase (IU)</th>
<th>tenecteplase (mg)</th>
<th>Volume of reconstituted solution (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60</td>
<td>6,000</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>60 to &lt; 70</td>
<td>7,000</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>70 to &lt; 80</td>
<td>8,000</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>80 to &lt; 90</td>
<td>9,000</td>
<td>45</td>
<td>9</td>
</tr>
<tr>
<td>90 and up</td>
<td>10,000</td>
<td>50</td>
<td>10</td>
</tr>
</tbody>
</table>

Step Eight: Give the tenecteplase

Dilute the tenecteplase with the provided diluant (40 mg to 8 mL or 50 mg to 10 mL).

**Give calculated dose of tenecteplase over 10 seconds**

- An existing intravenous line should be flushed with 0.9% NaCl (normal saline) first;
- It is good practice to flush the line with 0.9% NaCl solution after the tenecteplase;
- tenecteplase is incompatible with glucose solutions.

Step Nine: Full therapeutic anticoagulation
Use either an infusion of **unfractionated heparin** or **low molecular weight heparin** (e.g., enoxaparin sodium).

In the context where pathology is not readily available, low molecular weight heparin is often easier to use (6).

**exoxaparin sodium 1 mg/kg subcutaneously twice daily**

**Step Ten: Other adjunctive therapy**

- Consider intravenous beta-blocker (metoprolol 5 mg IV slow bolus at 0 min, 5 min and 10 min to give a total dose of 15 mg) then oral therapy (2).
  - IV beta-blockers decreases mortality when given early in acute myocardial infarction though the evidence is less clear in the reperfusion therapy setting;
  - it is more commonly used in the United States and parts of Europe and is routine therapy in Scandinavia.
- ACE-inhibitors: when started within 24 hours reduce morbidity and mortality.

**Step Eleven: Arrange for definitive care**

- The patient needs an admission to a coronary care unit.

**Discussion**

Where primary PCI is available, that is the optimum therapy. The strategy of using thrombolysis prior to PCI (within 1-3 hours) was is associated with more major adverse events than PCI alone (7).

Nevertheless, angioplasty after tenecteplase reduces the risk of recurrent events without an increase in major bleeding complications compared to tenecteplase alone (8) so patients should still be referred on for PCI after thrombolysis.

**Reference articles**

(1) Gibson M., Carrozza J., Laham R., Baim D. Primary PCI versus thrombolysis in acute ST elevation (Q wave) myocardial infarction: Clinical trails [electronic article]. UpToDate Patient Information. Last updated 10 May 2006. [Link]

(2) Fenton, D. Acute Coronary Syndrome [electronic article]. Emedicine. Last updated 7 August 2006. [Link]


(6) Tam M. How to use low molecular weight heparin [electronic article]. *The Medicine Box. Last updated: 21 July 2006.* [PDF :: 37 KB :: Link]


Last updated: Michael Tam (15 October 2006)

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