

How to give thrombolysis in acute myocardial infarction

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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).

Don't forget to take documented informed consent prior to giving thrombolysis. It is a commonly forgotten step.

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;

- or a new left bundle branch block.

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 not 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%

- Intracranial haemorrhage (age > 75 years): ~ 2%

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

Weight (kg)	tenecteplase (IU)	tenecteplase (mg)	Volume of reconstituted solution (mL)
< 60	6,000	30	6
60 to < 70	7,000	35	7
70 to < 80	8,000	40	8
80 to < 90	9,000	45	9
90 and up	10,000	50	10

Step Eight: Give the tenecteplase

Dilute the tenecteplase with the provided dilutant (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).

enoxaparin 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 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 trials [electronic article]. *UpToDate Patient Information*. Last updated 10 May 2006. [\[Link\]](#)

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(5) ASSENT-2 investigators. Single-bolus tenecteplase compared with front-loaded alteplase in acute myocardial infarction: the ASSENT-2 double-blind randomised trial. *Lancet* 1999;354:716-22.

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(8) Le May MR., Wells G., Labinaz M., et al. Combined angioplasty and pharmacological intervention versus thrombolysis alone in acute myocardial infarction (CAPITAL AMI study). *Evid Based Cardiovasc Med*. 2005 Dec;9(4):284-7.

Last updated: Michael Tam (15 October 2006)

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