IDENTIFICATION OF STEMI

Patients with STEMI (ST segment elevation myocardial infarction) or equivalent require emergent reperfusion with either primary percutaneous coronary intervention (PCI) or thrombolysis.

Patients with a suspected myocardial infarction should have ECG acquired and interpreted within 10 minutes of clinical presentation and compared to prior ECGs if available. Serial ECG recordings in symptomatic patients with an initial non-diagnostic ECG should be performed at 15 minutes intervals.

Identification of STEMI

At least 20 minutes of cardiac ischaemic symptoms with either:

- New ST segment elevation in 2 contiguous leads* OR
- New left bundle branch block** OR
- True posterior infarct - ST depression in leads V1-V3 may be suggestive of posterior infarction particularly when terminal T wave is positive - recommend perform leads V7-V9.

Additional notes

*Contiguous leads refers to lead groups; anterior (V1-V6), inferior (II, III, aVF), lateral (I, aVL). Pathological ST elevation:

LEADS V2-V3: ≥ 2.5mm in males < 40yrs, ≥ 2mm in males > 40yrs, or ≥ 1.5mm in females

LEADS V7-V9: ≥ 0.5mm, ≥ 1mm in males < 40yrs

All other LEADs: ≥ 1mm

Although not classified as contiguous leads, lead AVR and/or V1 elevation coupled with ST depression ≥ 1mm in 8 or more surface leads suggests multi-vessel ischaemia or left main coronary disease and in the presence of ongoing ischaemic symptoms and/or haemodynamic compromise immediate invasive evaluation is recommended.

** LBBB (left bundle branch block) on admission ECG in patients with acute chest pain remains a diagnostic problem. New or presumed LBBB is not specific for acute myocardial infarction and hence its presence should be taken in the clinical context. New LBBB from AMI is uncommon but when present would be expected to cause significant clinical sequelae as a very proximal occlusion would be required to involve the septal perforating arteries that supply the proximal left bundle branch.

Pre-existing LBBB can interfere with interpretation of ST segment elevation. Repolarisation in LBBB is normally characterised by ST segment deviation away from the direction of the terminal QRS waveform. Diagnostic algorithms such as Sgarbossa criteria (concordant ST elevation > 1mm any lead, concordant ST depression > 1mm in any leads V1-V3, or discordant ST elevation >5mm) can
be helpful to diagnose ischaemia. Concordant ST elevation (i.e. in leads with positive QRS deflection) appears to be the most sensitive indicator for coronary artery occlusion although the Sgarbossa criterion is limited by low sensitivity. Hence patients with suspected AMI with LBBB (particularly with haemodynamic instability, acute heart failure or positive Sgarbossa criteria) should be discussed urgently with the interventional cardiologist regarding urgent revascularisation. In others where the diagnosis of AMI is in doubt urgent echocardiogram can be useful to assess for anterior regional wall motion abnormalities.

**MANAGEMENT GUIDELINES**

1. Management of STEMI presenting to TPCH Emergency Department (ED) – Primary PCI  
2. Management of STEMI presenting to Non-PCI capable hospital – Pharmaco-invasive strategy  
3. RESCUE PCI  
4. Special situations;  
   a. Late presentation STEMI  
   b. Cardiogenic SHOCK  
   c. Intubated patients  
   d. QAS activation  
   e. Pre-hospital thrombolysis  
   f. Bleeding post thrombolysis

**1. INITIAL MANAGEMENT OF STEMI IN TPCH ED**

1. **Contact Ext 4004 for activation of the coronary catheter lab as soon as possible on identification of STEMI**

2. **Aspirin**: 300mg aspirin (non enteric coated) should be given immediately  
   Discuss the administration of aspirin with Consultant Cardiologist if patient has a documented allergy or adverse drug reaction to aspirin.

3. **Anticoagulation**: Intravenous heparin bolus as per heparin form nomogram up to 5000 units.  
   Discuss anticoagulation with Consultant Cardiologist if patient on warfarin or novel oral anticoagulant.

4. **Second antiplatelet loading dose (ADP Inhibition):**  
   Clopidogrel, ticagrelor OR prasugrel can be used as a second antiplatelet agent.  
   Clopidogrel is acceptable as default unless timing of discussion with Cardiologist permits administration of suggested alternative.

   **Clopidogrel 600mg** loading dose is acceptable in all situations.  
   **Ticagrelor 180mg or Prasugrel 60mg** loading doses can be considered in patients who are assessed as low bleeding risk.

   Note: Prasugrel is not advised in patients > 75years, Wt < 60kg or previous cerebrovascular accident (CVA) or intracranial haemorrhage (ICH).

5. **Analgesia** – titrated intravenous (IV) fentanyl if no contraindication

6. **Continuous ECG monitoring** must be initiated as soon as possible

7. The patient should have an IV cannula and the groin prepared. Avoid IV cannula over right wrist if possible as may interfere with radial artery access.

**Reperfusion strategy – Primary PCI**

Reperfusion therapy is indicated in all patients with symptoms of < 12 hours and ECG consistent with STEMI or STEMI equivalent (see above).
The preferred reperfusion strategy at TPCH is primary PCI for all STEMI patients presenting within 12hrs from onset of the chest pain.

Door to balloon time should be aimed at < 90 minutes and should be documented.

It is expected that catheter laboratory staff will be present in the hospital within 30 minutes of activation of the infarct angioplasty team. Intervention is generally undertaken only on the infarct related vessel unless evidence of cardiogenic shock.

**Thrombolysis may be considered in following situations at TPCH after discussion with Cardiologist:**

1. Significant renal impairment (serum creatinine > 300) and not on dialysis
2. Known anaphylactic reaction to contrast agents
3. Presentation is less than 3 hours from symptom onset and there is a delay in invasive strategy of over 90 minutes

**MANAGEMENT POST PRIMARY PCI**

Patients post primary PCI are initially managed in the Coronary Care Unit (CCU).

Post PCI ECG performed on arrival and repeated if recurrent chest pain.

Fasting blood glucose, lipid profile, CXR and transthoracic echocardiogram should be arranged after arrival to CCU.

Uncomplicated primary PCI patients (no ongoing chest pain, no ventricular arrhythmias and no evidence of left ventricular failure) can be transferred to the ward after 48 hours.

**Adjunctive Therapy post primary PCI**

1. **Aspirin** 100mg daily
2. **Second antiplatelet agent (see above):**
   - Clopidogrel 75mg daily OR
   - Ticagrelor 90mg twice daily OR
   - Prasugrel 10mg daily
3. **ACE inhibitor** if no contraindications. Angiotensin Receptor Blocker (ATRB) if intolerant to ACE inhibitor.
4. **Oral beta blocker** if no contraindications. (Contraindications include signs of heart failure, low output state, risk of cardiogenic shock, PR > 0.24s, second or third degree AV block, reactive airways disease)
5. **Statin** – All patients should be immediately commenced early on **atorvastatin 80mg daily** irrespective of their cholesterol level.
6. **Anti-ischaemic medication** as required – Patients requiring commencement of IV glyceryl trinitrate (GTN) for refractory ischaemia must be discussed with Cardiologist.
7. **Glycoprotein IIa/IIIb inhibitors** (abciximab, tirofiban, eptifibatide) administered at the discretion of the Interventional Cardiologist.
8. **Aldosterone antagonist** – Consider in patients with ejection fraction (EF) < 40% and diabetes or signs of heart failure.
9. **Proton pump inhibitor** – consider Pantoprazole in patients at risk of gastrointestinal (GI) bleeding (e.g. history of GI bleed, peptic ulcer, concomitant steroids or anticoagulation, elderly)

Following primary PCI systemic anticoagulation is generally not required unless specified by the treating Cardiologist or when there is a separate indication (e.g. atrial fibrillation [AF], mechanical heart valve, left ventricular thrombus).

DVT prophylaxis should be administered as per standard guidelines.
2. INITIAL MANAGEMENT OF STEMI IN NON-PCI CAPABLE HOSPITALS

A PHARMACO-INVASIVE strategy is recommended for patients presenting with STEMI to hospitals without PCI capabilities. This strategy is thrombolysis at presenting hospital followed by semi-urgent transfer to TPCH CCU for consideration of angiogram +/- PCI between 3 – 24 hours after successful thrombolysis.

It is preferable to transfer the patient immediately after thrombolysis rather than waiting for 90 minutes to assess the success of lysis if the patient referred from a peripheral hospital has high risk features (large anterior infarct, cardiogenic shock/hypotension and evidence of heart failure).

RESCUE PCI is reserved for patients where thrombolysis fails (see below).

Transfer of patients from other centres for primary PCI is generally not undertaken at present given the delays associated with such transfers. Transfer for Primary PCI should only be considered when there is a contraindication to thrombolysis or when very late presentation (see below) or time to transfer to coronary catheterisation laboratory is deemed to be within guidelines (first medical contact to device time < 120 minutes) – all cases must be discussed with Cardiologist.

FACILITATED PCI (thrombolysis immediately prior to planned primary PCI) is NOT recommended as associated with worse clinical outcomes.

Contraindications to Thrombolysis (ACCF/AHA guidelines 2013)

**Absolute**
1. Any prior intracranial haemorrhage
2. Known structural cerebral vascular lesion (e.g. AV malformation)
3. Known malignant intracranial neoplasm
4. Ischaemic stroke within 3 months (except ischaemic stroke within 4.5 hours)
5. Suspected aortic dissection
6. Active bleeding or bleeding diathesis (excluding menses)
7. Significant closed-head or facial trauma within 3 months
8. Intracranial or intraspinal surgery within 2 months
9. Severe uncontrolled hypertension (unresponsive to emergency therapy).
10. For streptokinase, prior treatment within the previous 6 months.

**Relative**
1. History of chronic, severe, poorly controlled hypertension
2. Severe uncontrolled hypertension on presentation (SBP > 180 mmHg or DBP > 110 mmHg)
3. History of prior ischaemic CVA > 3 months, dementia or known intracranial pathology not covered in contraindications
4. Traumatic or prolonged (greater than 10 mins) CPR
5. Major surgery (within < 3 weeks)
6. Recent (within 2 – 4 weeks) internal bleeding
7. Non-compressible vascular puncture
8. Pregnancy or within 1 week post partum
9. Active peptic ulcer
10. Current use of anticoagulants

**Administering Thrombolysis**
Indicated in STEMI within 12 hours of symptom onset if no contraindications. Thrombolysis should be administered with target door to needle time < 30 minutes.

A Fibrin-specific agent is generally recommended in combination with systemic anticoagulation and antiplatelet therapy.

**Tenecteplase (TNK-tPA) protocol**

Single IV bolus injection depending on weight:
Weight (kg) | TNK dose
---|---
< 60 | 30mg
61-70 | 35mg
71-80 | 40mg
81-90 | 45mg
>90 | 50mg

Alteplase (t-PA) Protocol

15mg/kg IV bolus followed by
0.75mg/kg IV given over 30 minutes (maximum 50mg) followed by
0.5mg/kg IV given over 60 minutes (maximum 35mg)

Commence haemodynamic observations every 10 minutes for 1.5 hours following injection.

A 60-minute assessment of perfusion should be undertaken with consideration for rescue PCI in patients with ongoing symptoms OR persistent ST elevation (i.e. lack of > 50% ST resolution in worst lead).

Even with successful lysis, the rate of reinfarction is significant and transfer to TPCH CCU for review with plan for coronary angiography +/- PCI is recommended and ideally performed 3 – 24 hours after thrombolysis (PHARMACO-INVASIVE strategy).

Adjunctive therapy post thrombolysis

1. **Aspirin** 300mg followed by 100mg daily
2. **Second antiplatelet agent:**
   - **Clopidogrel** 300mg loading dose followed by 75mg daily
   (Note: Ticagrelor and prasugrel have not been extensively tested in Thrombolysis patients.)
3. **Anticoagulation:**
   a. **IV heparin:** 60units/kg IV bolus with maximum dose 4000 units followed by IV infusion starting at 12 units/kg (maximum 1000 units/hours) and guided by APTT.
   OR
   b. **Enoxaparin:**
      i. **< 75 years:** 30mg IV followed within 15 minutes by 1mg/kg subcut 12 hourly (maximum 100mg each dose for first 2 doses).
      ii. **> 75 years:** No IV bolus. 0.75mg/kg subcut 12 hourly (maximum 75mg each dose for first 2 doses).

Anticoagulation should be continued until revascularisation (if performed) otherwise for duration of hospitalisation up to maximum of 8 days.

4. **ACE inhibitor** if no contraindications. ATRB if intolerant to ACE inhibitor.
5. **Oral beta blocker** if no contraindications. (Contraindications include signs of heart failure, low output state, risk of cardiogenic shock, PR > 0.24s, second or third degree AV block, reactive airways disease.)
6. **Statin** – All patients should be immediately commenced early on **Atorvastatin 80mg daily** irrespective of their cholesterol level.
7. **Anti-ischaemic medication** as required – Patients requiring commencement of IV GTN for refractory ischaemia must be discussed with Cardiologist.
8. **Aldosterone antagonist:** Consider in patients with EF < 40% and diabetes or signs of heart failure.
9. **Proton pump inhibitor** – consider Pantoprazole in patients at risk of GI bleeding (e.g. history of GI bleed, peptic ulcer, concomitant steroids or anticoagulation, elderly.)

**Combining Thrombolysis and Glycoprotein IIbIIIa inhibitors is NOT recommended.**
3. RESCUE PCI

Failed thrombolysis is failure to achieve > 50% ST segment resolution in the lead with maximum ST segment elevation at baseline at 60 – 90 minutes post thrombolysis.

The absence of chest pain has been shown to not be a reliable predictor of reperfusion – persistent ST elevation alone is sufficient to make the diagnosis.

The patient should be transferred (if not already) immediately to TPCH CCU for review and immediate coronary angiogram with view for rescue PCI.

GP IIb/IIIa inhibitors (Tirofiban or Reopro) should generally be avoided in the setting of rescue PCI.

Repeat thrombolysis is NOT recommended.

4. SPECIAL SITUATIONS

a. Late presentation STEMI (> 12 hours from onset of pain)

Reperfusion should be considered if there is clinical and/or electrical evidence of ongoing ischaemia even if symptoms started > 12 hours ago as often symptom onset can be unclear.

Thrombolysis success is time dependent and in this group is less effective and does not generally reduce infarct size or preserve LV function and therefore is usually not indicated.

Primary PCI is indicated in this group if there is ongoing evidence of ischaemia even if symptoms started > 12 hours beforehand if pain and ECG changes have been stuttering.

Primary PCI may be considered for stable patients presenting 12 – 24 hours after symptom onset.

Patients with cardiogenic shock should be considered for primary PCI.

Routine PCI of a totally occluded artery > 24 hours after symptoms onset in stable patients without signs of ischaemia is not recommended.

b. Cardiogenic Shock

Cardiogenic shock complicates 6 – 10% of STEMI patients and is a leading cause of death with inhospital mortality rates approaching 50%.

The causes include:

1. Pump failure due to infarction or ischaemic dysfunction (“stunning”)
2. Right ventricular (RV) infarct or ischaemic dysfunction
3. Brady or tachy-arrhythmia
4. Mechanical complications, e.g. acute mitral regurgitation (MR), ventricular septal or free wall rupture
5. Other: tamponade, hypovolaemia, drug-induced hypotension

The degree of heart failure following myocardial infarction may be classified according to the Killip criteria:

- Killip 1: No rales or S3
- Killip 2: Rales < 50% of lung fields, sinus tachycardia or S3
- Killip 3: Pulmonary oedema
- Killip 4: Cardiogenic shock

Patients with heart failure or cardiogenic shock should be discussed with Cardiologist immediately and evaluated immediately for cause whilst resuscitation measures are instituted.
ECG is mandatory for evaluation of recurrent ischaemia or arrhythmia.

Urgent TTE is mandatory for assessing LV and RV function, valvular disease and excluding mechanical complication and cardiac tamponade.

Patients with evidence of ongoing or recurrent ischaemia should undergo emergent coronary angiogram and revascularisation / intra-aortic balloon pump/mechanical support.

c. Intubated patients

Patients intubated in the field by Queensland Ambulance Service or in ED require notification to Intensive Care Unit (ICU) for ventilatory support during primary PCI and continued care post procedure.

Patients are usually briefly assessed and stabilised in ED with handover of airway management occurring either in ED or on arrival to coronary catheterisation laboratory.

d. QAS Activation

QAS may activate the coronary catheterisation laboratory via the ACS Case Manager (during hours) or Interventional Cardiologist on call (afterhours) on Ext 4004.

QAS will be directed to take the patient directly to the catheterisation laboratory if team assembled and position available (usually during hours) OR to take the patient to ED initially until after-hours catheterisation laboratory team is activated and assembled – once in place the catheterisation laboratory team will contact ED for immediate transfer of patient for primary PCI.

e. Pre-Hospital Thrombolysis

Occasionally patients receive pre-hospital thrombolysis via QAS.

These patients should initially be assessed in ED and transferred to CCU if stable.

Assessment of reperfusion should be undertaken at 60 minutes post-thrombolysis.

If thrombolysis successful, then usual PHARMACO-INVASIVE protocol should be followed with coronary angiogram performed 3 – 24 hours after thrombolysis.

If failed thrombolysis at 60 minutes, then RESCUE PCI should be performed.

FACILITATED PCI (thrombolysis followed by immediate primary PCI) is NOT recommended.

f. Management of major bleeding (including intracranial bleeding) after thrombolytic therapy:

- Cease further thrombolytic therapy, heparin and antiplatelet therapy
- CT Scan for suspected IC bleed, and consider neurosurgical consult (RBWH)
- Urgent haematology consult recommended
- Consider:
  - Reverse heparin with protamine sulphate
  - Platelet transfusion 6 – 8 units
  - Fresh frozen plasma 2 units and/or Prothrombinex
  - Cryoprecipitate 10 units
  - Blood transfusion as necessary
  - For intracranial haemorrhage, consider tranexamic acid
MARKETING/COMMUNICATION
Marketing/Communication Responsibility
CCU/CPAS Director & NUM, CCU CNT
CNC Q&S Heart-Lung Program
Marketing/Communication Strategy
- Publish on QHEPS
- SQU notification processes
- Table at management team meetings
- Notification of HOD & relevant staff

AUDIT STRATEGY
Level of Risk
Medium
Audit Strategy
Incident/PRIME monitoring
Audit Tool Attached
N/A
Audit Date
Annually
Audit Responsibility
CCU/CPAS Management Team
Key Elements/Indicators/Outcomes
- Identification and prompt management of issues related to the identification and management of STEMI patients

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Minor Review Date 2
N/A
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CCU/CPAS Management Team

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N/A

**SEARCH INFORMATION**

**Key Words**
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**EQuIP and other Standards**
Signature ...................................................................... Date ................................
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