CLINICAL PRACTICE GUIDELINES

Management of ST Elevation Myocardial Infarction (STEMI) 2019

4th Edition
Rational

- Process
  - Writing Committee
  - External Reviewers
  - Target Group
  - Target Population

- Recommendations

- Performance Measures

- Implementation Strategies
Mean Age of ACS
- Malaysia: 58.6 years
- Thailand: 63.5 years
- Singapore: (median: 68.3-69.2 years)

Mean age: 58.6 (12.2) years

Number of ACS admissions = 17,771
<table>
<thead>
<tr>
<th>Year</th>
<th>Outcome</th>
<th>Outcome at discharge</th>
<th>30-day</th>
<th>1-year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>2011-2013</td>
<td>Alive</td>
<td>13,633</td>
<td>92.3</td>
<td>13,440</td>
</tr>
<tr>
<td></td>
<td>Died</td>
<td>1,130</td>
<td>7.7</td>
<td>1,323</td>
</tr>
<tr>
<td>2014-2015</td>
<td>Alive</td>
<td>16,462</td>
<td>92.6</td>
<td>16,137</td>
</tr>
<tr>
<td></td>
<td>Died</td>
<td>1,309</td>
<td>7.4</td>
<td>1,634</td>
</tr>
</tbody>
</table>
# MEMBERS OF THE EXPERT PANEL

## Chairperson

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Jeyamalar Rajadurai</td>
<td>Consultant Cardiologist</td>
<td>Subang Jaya Medical Centre, Selangor</td>
</tr>
</tbody>
</table>

## Members: (in alphabetical Order)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position and Title</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Abdul Kahar Ghapar</td>
<td>Consultant Cardiologist, Head of Cardiology</td>
<td>Hospital Serdang, Kuala Lumpur</td>
</tr>
<tr>
<td>Dr Amin Ariff Nuruddin</td>
<td>Consultant Cardiologist, Head of Cardiology</td>
<td>Institute Jantung Negara, Kuala Lumpur</td>
</tr>
<tr>
<td>Dr Ahmad Tajuddin Mohamad Nor</td>
<td>Consultant Emergency Physician</td>
<td>Hospital Tengku Ampuan Rahimah, Klang</td>
</tr>
<tr>
<td>Dr Gunavathy Muthusamy</td>
<td>Consultant Physician/Endocrinologist</td>
<td>Head of General Medicine, Hospital Shah Alam</td>
</tr>
<tr>
<td>Dr Lee Kun Yun</td>
<td>Public Health Specialist</td>
<td>Institute for Health Management, Ministry of Health</td>
</tr>
<tr>
<td>Dr Narul Aida Salleh</td>
<td>Family Medicine Specialist</td>
<td>Klinik Kesihatan Kuala Lumpur</td>
</tr>
<tr>
<td>Dr Ong Mei Lin</td>
<td>Consultant Cardiologist</td>
<td>Gleneagles Penang</td>
</tr>
<tr>
<td>Dr Saari Mohamad Yatim</td>
<td>Consultant Rehabilitation Physician</td>
<td>Hospital Serdang</td>
</tr>
<tr>
<td>Dr Sabariah Faizah Jamaluddin</td>
<td>Consultant Emergency Physician</td>
<td>Hospital Sungai Buloh</td>
</tr>
<tr>
<td>Dr Wardati binti Mazlan Kepli</td>
<td>Clinical Pharmacist</td>
<td></td>
</tr>
<tr>
<td>Dr Wan Azman Wan Ahmad</td>
<td>Consultant Cardiologist</td>
<td>University Malaya Medical Centre</td>
</tr>
<tr>
<td>Name</td>
<td>Position and Details</td>
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</tr>
<tr>
<td>Dr Anwar Suhaimi</td>
<td>Rehabilitation Physician, University Malaya Medical Centre</td>
<td></td>
</tr>
<tr>
<td>Dr Azerin Othman,</td>
<td>Consultant Cardiologist, Hospital Raja Perempuan Zainab II, Kota Baru</td>
<td></td>
</tr>
<tr>
<td>Dr Kauthaman a/l A Mahendran</td>
<td>Consultant Physician and Head, Department of Medicine, Hospital Melaka</td>
<td></td>
</tr>
<tr>
<td>Dr Keshab Chandran Nair</td>
<td>General Practitioner, Klinik Anis, 17, Jalan Bunga Melur 2/18, Section 2, 40000 Shah Alam</td>
<td></td>
</tr>
<tr>
<td>Dr Liew Huong Bang</td>
<td>Consultant Cardiologist, Hospital Queen Elizabeth II, Sabah</td>
<td></td>
</tr>
<tr>
<td>Dr Mastura Hj Ismail</td>
<td>Family Medicine Specialist, Klinik Kesihatan Seremban 2</td>
<td></td>
</tr>
<tr>
<td>Dr Ong Tiong Kiam</td>
<td>Consultant Cardiologist, Sarawak Heart Centre</td>
<td></td>
</tr>
<tr>
<td>Dr Rashidi Ahmad</td>
<td>Head, Unit Akademik Perubatan Kecemasan, Fakulti Perubatan, Universiti Malaya</td>
<td></td>
</tr>
<tr>
<td>Dr Ridzuan Mohd Isa</td>
<td>Consultant Emergency Physician, Hospital Ampang</td>
<td></td>
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<tr>
<td>Dr. Sahimi Bt Mohamed</td>
<td>Head of Clinical Section, Pharmacy Department, Hospital Tunku Aminah Kuantan</td>
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</tbody>
</table>
### WHAT’S NEW IN THE CURRENT GUIDELINES

<table>
<thead>
<tr>
<th>Distinguishing the difference between myocardial injury and Myocardial Infarction (MI) - Recognition that all myocardial injury is not necessarily due to MI.</th>
<th>Previous CPG STEMI (2014)</th>
<th>Current CPG STEMI (2019)</th>
</tr>
</thead>
</table>
| No clear differentiation between myocardial injury and MI | **Myocardial injury** is reflected by a level above the 99th percentile of the upper reference limit (URL) of troponin. Myocardial injury may be due to:  
- Ischemia  
- Non-ischemic causes | **MI is myocardial injury due to ischemia.**  
STEMI is MI with ST elevation seen on the resting ECG. |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Brief statement about Pre-hospital Care/personnel</td>
<td>Providing a <strong>structured format of response to an emergency call for “chest pain.”</strong> To treat STEMI promptly preferably by Primary PCI by transporting the patient directly to a PCI capable hospital. <strong>Outlining key care processes to shorten door to balloon (device) time (DBT) and improve quality of care during transport.</strong> <strong>Encouraging pre-hospital thrombolysis</strong> if transport time to a PCI capable centre is long and trained doctor/PHC personnel are available. If this is not available, for in-hospital thrombolysis at the nearest hospital. <strong>Identifying training of PHC personnel as an important priority.</strong></td>
<td></td>
</tr>
</tbody>
</table>
Severe angina attack?
Chest pain which is retrosternal (below your breastbone) severe, crushing, squeezing or pressing in nature, lasting more than 30 minutes, associated with:
- profuse sweating
- nausea or vomiting
- shortness of breath
- Not relieved by sub-lingual GTN?

You could be HAVING A HEART ATTACK!
DO NOT DRIVE!

Ask for Ambulance Service.

MEDICAL EMERGENCY COORDINATION CENTRE MOH

Caller Interrogation process

Online Guide to Take Aspirin

Aspirin: A 10 cents wonder drug!

Assistant Medical Officer gives Aspirin

Acute Coronary Syndrome (ACS)

CLINICAL PATHWAY FOR STEMI IN PHCAS

MOH CPG on STEMI/NSTEMI recommends the early provision of Aspirin in ACS (I,A) for immediate antiplatelet effect to limit thrombosis or clot
<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>No mention of STEMI networks</td>
<td>Identifying the key points in establishing a STEMI network.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Encouraging the setting up of STEMI Networks throughout the country.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establishing time intervals to reduce total ischaemic time and achieve timely early reperfusion.</td>
</tr>
</tbody>
</table>
MySTEMI Network

MySTEMI Referral Network

Legend
- PCI-capable Centre (Hub)
- Non-PCI-capable Centre (Spoke)

UMMC (24/7)
PPUKM
Serdang
IJN (24/7)
UITM

Hospital Banting
Hospital Putrajaya
Hospital Serdang
Hospital Kajang
Hospital Shah Alam
University Malaya Medical Centre
Institut Jantung Negara Ampang
Hospital Kuala Lumpur
Hospital Sungai Buloh
Hospital Seiayang

Direct referral
GP referral

MySTEMI network program
<table>
<thead>
<tr>
<th>Diagnosing reinfarction-Troponins can also be used for reinfarction</th>
<th>Previous CPG STEMI (2014)</th>
<th>Current CPG STEMI (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a patient with recurrent chest pain following STEMI, a ≥ 20% increase in the value of Creatine Kinase-Myocardial Band (CKMB) from the last sample suggests reinfarction.</td>
<td>If a patient is suspected of having a reinfarction on clinical grounds, a ≥ 20% increase in the value of either troponins or CKMB between 2 samples 3-6 hours apart supports the diagnosis</td>
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</tbody>
</table>
| ECG to be done preferably within 10 minutes | For Primary PCI:  
- Door to balloon (DBT) time < 90 minutes  
- If transported from a non-PCI hospital:  
  DBT < 120 minutes | FMC to ECG interpretation < 10 min  
For Primary PCI:  
- FMC or directly transported by ambulance to PCI capable centre:  
  DBT < 90 minutes  
- FMC at non-PCI (spoke) hospital;  
  DBT < 120 minutes  
  - Door in Door Out (DIDO): < 30 minutes.  
  - Transfer to PCI capable centre:  
    < 60 minutes. |
| For fibrinolysis: |  
- Door to needle time < 30 minutes | For fibrinolysis:  
- FMC to thrombolysis < 30 minutes  
  (this could be in-hospital or pre-hospital in an ambulance equipped with the necessary facilities) |
If time intervals/transfer times are anticipated to be longer than stated, initiate fibrinolysis first and then consider same day transfer for PCI as part of pharmaco-invasive strategy (3-24 hours post lysis) or for transfer later depending on the clinical condition of the patient and the available resources.
**WHAT’S NEW IN THE CURRENT GUIDELINES**

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<tr>
<td>If the time from STEMI diagnosis to wire crossing is &gt;120 minutes, then pre-hospital or nearest in-hospital fibrinolysis is an option. Then consider transfer for a pharmaco-invasive strategy.</td>
<td>New section on Fibrinolysis in an unstable patient</td>
<td></td>
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<tr>
<td>As part of a pharmaco-invasive strategy in stable patients who have been given fibrinolytics and an elective PCI can be performed within 3 - 24 hours. (IIa, B)</td>
<td>Early PCI should be considered in the following situations: • Failed reperfusion or re-occlusion after fibrinolytic therapy. (IIa, B) • Cardiogenic shock or acute pulmonary oedema that develops after initial presentation. (I, B)</td>
<td>Early PCI should be considered in the following situations: • Failed reperfusion or re-occlusion after fibrinolytic therapy. (I,A) • Cardiogenic shock or acute pulmonary oedema that develops after initial presentation. (I,A) • STEMI TIMI risk score of ≥ 6.0 at admission. (I,C) • If symptoms are completely relieved and ST segment completely normalises either spontaneously or after GTN (sublingual or spray) or anti platelet therapy. (I,C)</td>
</tr>
</tbody>
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### WHAT’S NEW IN THE CURRENT GUIDELINES

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<td></td>
<td>Patients presenting with ischaemic type chest pains &gt; 30 mins and continuing to have chest pains but with a non-interpretable ST-segment on the ECG, such as those with bundle branch block (assumed new onset RBBB) or ventricular pacing, may be having a MI, and should be considered for a PCI strategy. (IIa, A)</td>
</tr>
<tr>
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<td>Radial access is recommended over femoral access if performed by an experienced radial operator. (I,A)</td>
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<td>Stenting is recommended (over balloon angioplasty) for primary PCI. (I,A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stenting with new-generation DES is recommended over BMS for primary PCI. (I,A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Routine use of thrombus aspiration catheters is not recommended. (III, A)</td>
</tr>
<tr>
<td>Delayed angiography and PCI - Symptom onset &gt;12h,</td>
<td>-</td>
<td>A primary PCI strategy is indicated in the presence of ongoing symptoms suggestive of ischaemia, haemodynamic instability, or life-threatening arrhythmias. (I, B)</td>
</tr>
</tbody>
</table>
KEY TAKE HOME MESSAGES
Key Message #1: -Epidemiology of STEMI

- From the latest report of the National Cardiovascular Database - Acute Coronary Syndrome (NCVD-ACS) Registry 2014-2015:

  ➢ The **STEMI mortality in Malaysia remains high**- the in-hospital, 30-day and 1-year mortality following STEMI being 10.6%, 12.3% and 17.9% respectively.

  ➢ Patients receiving reperfusion (Primary PCI or fibrinolytic) had better survival compared to patients who did not receive any reperfusion.

  ➢ Patients who had PCI during the index hospitalisation (including those who underwent Primary PCI and PCI both fibrinolysis) had **better short-term and long-term survival** as compared to those who did not undergo in-hospital PCI. This data is consistent with that of other registries.
Key Message #1: -Epidemiology of STEMI

- From the latest report of the National Cardiovascular Database - Acute Coronary Syndrome (NCVD-ACS) Registry 2014-2015:

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  - Patients who had PCI during the index hospitalisation (including those who underwent Primary PCI and PCI both fibrinolysis) had better short-term and long-term survival as compared to those who did not undergo in-hospital PCI. This data is consistent with that of other registries.
Myocardial Infarction (MI) is defined pathologically as myocardial cell death due to prolonged ischaemia. Myocardial injury is myocardial cell death due to non ischaemic causes.

MI is diagnosed by the rise and/or fall in cardiac troponins, with at least one value above the 99\textsuperscript{th} percentile of the upper reference limits (URL), and accompanied with \textit{at least one} of the following:

- Clinical history consistent with chest pain of ischaemic origin.
- ECG changes
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.
- Identification of an intracoronary (IC) thrombus by angiography or autopsy.

MI may be \textbf{STEMI} or Non STEMI
Clinical spectrum of ACS.*

Clinical spectrum of ACS.*

Presentation

Provisional Diagnosis

Ischaemic Chest Discomfort

AC

ECG

ST Elevation

No ST Elevation

Normal

Elevated

Cardiac Biomarkers

Unstable Angina

NSTEMI

Final Diagnosis

Elevated

STEMI

MI

STEMI is diagnosed when there is:

- ST elevation of $\geq 1$ mm in 2 contiguous leads or
- a new onset LBBB in the resting ECG in a patient with
- ischaemic type chest pains of $> 30$ minutes and accompanied by
- a rise and fall in cardiac biomarkers.
Key Message #2: - Diagnosis of STEMI

- **New onset Right Bundle Branch Block** with ST elevation of ≥1 mm in 2 contiguous leads does not interfere with the diagnosis of STEMI.

- Patients having prolonged ischaemic type chest pain of > 30 minutes and having:
  - a normal ECG or ST segment depression may be having either **Unstable angina (UA)** or **Non-ST Elevation MI (NSTEMI)**.
  - a **non-interpretable resting ECG** (eg paced rhythm, RBBB etc) may be having an **NSTEMI**. If pain persists, they should be considered for early Percutaneous Coronary Intervention (PCI) if facilities are available. Fibrinolysis is not advisable.

- There are separate guidelines for UA/NSTEMI.
<table>
<thead>
<tr>
<th>Location</th>
<th>Leads</th>
<th>ECG findings</th>
</tr>
</thead>
</table>
| Anteroseptal           | V1 – V3| • ST elevation in leads V2-3:  
                           |         | ≥ 0.25 mV (in males < 40 years),  
                           |         | ≥ 0.2 mV (in males ≥ 40 years)  
                           |         | ≥ 0.15 mV in females,  
                           |         | • Q wave                                                                                                                            |
| Extensive anterior     | V1 – V6| • ST elevation of ≥ 0.1 mV in all leads except leads V2-V3. In leads V2-3:  
                           |         | ≥ 0.25 mV (in males < 40 years),  
                           |         | ≥ 0.2 mV (in males ≥ 40 years)  
                           |         | ≥ 0.15 mV in females,  
                           |         | • Q wave                                                                                                                            |
| Posterior              | V7 – V8| • ST elevation≥ 0.05 mV (≥ 0.1 mV in men < 40 years),  
                           |         | • Q wave                                                                                                                            |
| Posterior              | V1 – V2| • ST depression, Tall R wave                                                                                                               |
| Anterolateral          | I, AVL, V5 – V6 | • ST elevation ST elevation of ≥ 0.1 mV, Q wave                                                                                           |
| Inferior               | II, III, AVF | • ST elevation ST elevation of ≥ 0.1 mV, Q wave                                                                                           |
| Right Ventricular (RV) | V4R    | • ST elevation≥ 0.5 mm (≥ 1 mm in men < 30 years old).                                                                                     |
Key Message #3: - Clinical Presentation and Pitfalls in Diagnosis

- Atypical presentations can occur in the elderly, women and in diabetic persons.

- If the initial ECG is non-diagnostic, it may need to be repeated at frequent intervals to detect evolving changes of STEMI. Additional chest leads (V 7-9) and right ventricular leads may also be helpful.

- Too early a measurement of the cardiac biomarkers can sometimes result in misleadingly low levels.
Key Message #4: - Pre-Hospital Management:

- The public and Pre-hospital Care (PHC) personnel should be educated on the importance of early diagnosis and the benefits of early treatment.

- Patients with suspected STEMI should be given soluble or chewable 300mg aspirin and 300 mg clopidogrel.

- These patients should be *rapidly transported* to the hospital for early initiation of reperfusion strategies.

- **DO NOT GO TO A CLINIC.**
The **objective** of a STEMI network is to link non-PCI-capable centres to PCI-capable centres with the aim of providing PCI services in a timely manner for patients:

- **With STEMI**

  - Who have been given fibrinolytic therapy and:
    - have failed reperfusion, or;
    - as part of a pharmaco-invasive strategy, or;
    - have high-risk features requiring early intervention.

- The optimal treatment of these patients should be based on the implementation of networks between hospitals (‘hub’ and ‘spoke’) and linked by an efficient ambulance service.
MySTEMI Network

MySTEMI Referral Network

Legend:
- PCI-capable Centre (Hub)
- Non-PCI-capable Centre (Spoke)
- UMMC (24/7)
- PPUKM
- Serdang
- IJN (24/7)
- UITM

Hub

Direct referral

GP referral

Spoke

MySTEMI Network Program

University Malaya Medical Centre

Hospital Shah Alam

Hospital Klang (HTAI)

Hospital Kajang

Hospital Putrajaya

Hospital Banting

Hospital Seiayang

Hospital Kuala Lumpur

Institut Jantung Negara Ampang

Hospital Ampang

Hospital Sungai Buloh

Legend:
- PCI-capable Centre (Hub)
- Non-PCI-capable Centre (Spoke)
- UMMC (24/7)
- PPUKM
- Serdang
- IJN (24/7)
- UITM
Key Message #6: - Initial Management

- Early management of STEMI is directed at:
  - Pain relief.
  - Establishing early reperfusion.
  - Treatment of complications.
Flow Chart 1: **Management of patients presenting with STEMI**
CHEST PAIN / CHEST PAIN EQUIVALENT

Continuous ECG monitoring
Sublingual glyceryl trinitrate (GTN) (if no contraindication)
Aspirin +
Clopidogrel #
Analgesia
Oxygen [if oxygen saturation (SpO₂) < 95%]

Assessment for reperfusion:
Onset of symptoms:
Preferred option:
Second option:
Subsequent management:

Concomitant initial management includes:

Electrocardiography
Cardiac Biomarkers

Concomitant Therapy:

# or ticagrelor or prasugrel (after angiogram)

< 3 hours
Primary PCI** or Fibrinolytic Therapy

3-12 hours
Primary PCI**

> 12 hours
Medical Therapy ± Antithrombotics

Fibrinolytics
Primary PCI

Consider PCI within 3-24 hours if fibrinolytics are administered as part of the pharmaco-invasive strategy

PCI if ongoing ischaemia or haemodynamic instability

Anti-platelet Therapy (DAPT)
Statin
β-blockers
ACE-Is/ ARBs
MRA

* When clinically indicated
** Preferred option in:
- high-risk patients
- presence of contraindications to fibrinolytic therapy and/or
- if the anticipated time intervals/transport times are within that stated in Flow Chart 2.
Key Message #7: - Reperfusion Strategies

“Time is muscle”

Every patient with STEMI should have the occluded artery reopened (reperfusion therapy) as soon as possible after the onset of symptoms.
Reperfusion therapy is indicated in all patients with symptoms of ischaemia of <12 hours duration and persistent ST-segment elevation.

Primary PCI is superior to fibrinolysis for STEMI when performed in a timely manner at experienced centres. (see Flow Chart 2)
Flow Chart 2:

**Time intervals to determine choice of reperfusion strategy**
ONSET OF CHEST PAIN

Ambulance

Travel time: <90 mins

PCI capable centre*

Time to wire crossing

Travel time: <60 mins

Non-PCI capable centre**

DIDO ***: <30 mins

DBT: <120 mins

PCI capable centre*

DBT: <30 mins

Time to wire crossing

If time intervals/transfer times are anticipated to be longer than stated, initiate fibrinolysis first and then consider same day transfer for PCI as part of pharmaco-invasive strategy (3-24 hours post lysis) or for transfer later depending on the clinical condition of the patient and the available resources.

First Medical Contact

* PCI capable centre: Hub Hospital
** Non-PCI capable centre: Spoke Hospital
*** DIDO: Door In Door Out
DBT: Door to balloon (device) time
Key Message #7: - Reperfusion Strategies

- If the patient presents at a PCI centre, then the time from FMC to wire crossing should be less than \(< 90\) minutes.

- If transferred from a centre with no PCI facilities, the time from FMC to wire crossing should be less than \(< 120\) minutes (including transfer delay). This is made up of:
  - door-in-door-out (DIDO) of non–PCI-capable hospital (spoke): \(< 30\) minutes.
  - Transport time to PCI-capable centre (hub): \(\leq 60\) minutes.
  - Door of PCI capable centre to wire crossing: \(\leq 30\) minutes.

- If the time delay to primary PCI is longer than \(>120\) minutes, the best option is to give fibrinolytic therapy and make arrangements to transfer the patient to a PCI capable centre for a pharmaco-invasive strategy.
If the patient presents at a PCI centre, then the time from FMC to wire crossing should be less than \(<90\) minutes.

If transferred from a centre with no PCI facilities, the time from FMC to wire crossing should be less than \(<120\) minutes (including transfer delay). This is made up of:

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- Door of PCI capable centre to wire crossing: \(<30\) minutes.

If the time delay to primary PCI is longer than \(>120\) minutes, the best option is to give fibrinolytic therapy and make arrangements to transfer the patient to a PCI capable centre for a pharmaco-invasive strategy.
ONSET OF CHEST PAIN

- **Ambulance**
  - Travel time: <90 mins

- **PCI capable centre***
  - Time to wire crossing: DBT: <90 mins

- **Non-PCI capable centre**
  - Travel time: <60 mins

* PCI capable centre: Hub Hospital
** Non-PCI capable centre: Spoke Hospital
*** DIDO: Door In Door Out
DBT: Door to balloon (device) time

If time intervals/transfer times are anticipated to be longer than stated, initiate fibrinolysis first and then consider same day transfer for PCI as part of pharmaco-invasive strategy (3-24 hours post lysis) or for transfer later depending on the clinical condition of the patient and the available resources.
Key Message #7: - Reperfusion Strategies

- When fibrinolytic therapy is administered, the Door to Needle time (DNT) should be < 30 minutes.

- Whenever possible, patients given fibrinolytic therapy should be considered for a pharmaco-invasive approach (elective angiogram within 3-24 hours post fibrinolysis).
CHEST PAIN / CHEST PAIN EQUIVALENT

Continuous ECG monitoring
Sublingual glyceryl trinitrate (GTN) (if no contraindication)
Aspirin +
Clopidogrel or ticagrelor
Analgesia
Oxygen [if oxygen saturation (SpO₂) < 95%]

Assessment for reperfusion:

Onset of symptoms:

Preferred option:

Second option:

Concomitant initial management includes:

Concomitant Therapy:

Primary PCI** or Fibrinolytic Therapy

Primary PCI**

Medical Therapy ± Antithrombotics

Fibrinolytics

Consider PCI within 3-24 hours if fibrinolytics are administered as part of the pharmaco-invasive strategy

PCI if ongoing ischaemia or haemodynamic instability

Anti-platelet Therapy (DAPT)
Statin
β-blockers
ACE-Is/ ARBs
MRA

* When clinically indicated
** Preferred option in:
- high-risk patients
- presence of contraindications to fibrinolytic therapy and/or
- if the anticipated time intervals/transport times are within that stated in Flow Chart 2.
<table>
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<tr>
<th>INTERVENTION</th>
<th>GRADE OF RECOMMENDATION</th>
<th>LEVEL OF EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REPERFUSION THERAPY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation 1:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Primary PCI: Strategy of choice if:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Done within the time intervals stated in Flow chart 1 and 2.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>• There are contraindications to fibrinolysis.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>• High-risk patients.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Recommendation 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Fibrinolytic therapy: Strategy of choice if:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• DBT &gt; 90 minutes if FMC in a PCI centre and &gt; 120 min if transferred from non-PCI centre.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>• No contraindications to fibrinolysis.</td>
<td>I</td>
<td>A</td>
</tr>
</tbody>
</table>

*Please refer to Flow Chart 1 & 2 for details*
<table>
<thead>
<tr>
<th>INTERVENTION</th>
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</thead>
<tbody>
<tr>
<td><strong>Recommendation 3:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin: Loading dose of 300 mg followed by maintenance dose of 75 mg – 150 mg daily.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>+ (PLUS) Clopidogrel: Loading dose of 300 mg followed by maintenance dose of 75 mg daily (for at least 1 month).</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ticagrelor: Loading dose of 180 mg followed by maintenance dose of 90 mg twice daily (bd) to be administered to patients undergoing primary PCI.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prasugrel: Loading dose of 60 mg followed by maintenance dose of 10 mg (to be administered only prior to primary PCI).</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td><strong>Recommendation 4:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antithrombotics to be given to patients:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Who received fibrinolytic therapy and did not undergo PCI.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Enoxaparin</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>➢ Heparin</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>➢ Fondaparinux</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>• Underwent PCI and have atrial fibrillation (AF).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Warfarin + DAPT or DOAC + DAPT</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>• With mural thrombus.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 2: Level of evidence and grade of recommendation for acute therapy of STEMI

<table>
<thead>
<tr>
<th>INTERVENTION</th>
<th>GRADE OF RECOMMENDATION</th>
<th>LEVEL OF EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCOMITANT PHARMACOTHERAPY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendation 5: β-blockers: For all patients if no contraindications</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Recommendation 6: ACE-Is: For all patients with no contraindications.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Recommendation 7: High dose Statins: For all patients if no contraindications.</td>
<td>I</td>
<td>A</td>
</tr>
</tbody>
</table>
Table 3: Level of evidence and grade of recommendation for secondary prevention post-STEMI

<table>
<thead>
<tr>
<th>INTERVENTION</th>
<th>GRADE OF RECOMMENDATION</th>
<th>LEVEL OF EVIDENCE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation 8: Smoking Cessation</td>
<td>I</td>
<td>B</td>
<td>At least 30-60 minutes most days of the week.</td>
</tr>
<tr>
<td>Exercise</td>
<td>I</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

Recommendation 9: CONCOMITANT PHARMACOTHERAPY

| Aspirin                             | I                        | A                | Maintenance dose: 75-150 mg daily.                                      |
| + Clopidogrel                       | I                        | A                | Maintenance dose 75 mg daily to be given for at least 1 month, preferably 1 year, following fibrinolytic therapy and for up to 1-year post- primary PCI*. |
| OR                                  |                          |                  |                                                                          |
| + Ticagrelor                        | I                        | B                | Maintenance dose 90 mg twice daily for up to 1-year post- primary PCI*.  |
| OR                                  |                          |                  |                                                                          |
| + Prasugrel                         | I                        | B                | Maintenance dose 10 mg daily for up to 1-year post- primary PCI*.        |

* Duration of therapy will depend on Bleeding risks vs ischemic risk
Table 3: Level of evidence and grade of recommendation for secondary prevention post-STEMI

<table>
<thead>
<tr>
<th>INTERVENTION</th>
<th>GRADE OF RECOMMENDATION</th>
<th>LEVEL OF EVIDENCE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation 9:</td>
<td><strong>CONCOMITANT PHARMACOTHERAPY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ β-blockers</td>
<td>I</td>
<td>A</td>
<td>Consider long-term therapy (&gt;1 year) for patients with LVEF &lt;40%.</td>
</tr>
<tr>
<td></td>
<td>IIb</td>
<td>B</td>
<td>Routine administration &gt; 1 year post STEMI in all patients with no angina/ischemia and normal LV function</td>
</tr>
<tr>
<td>+ ACE-Is</td>
<td>I</td>
<td>A</td>
<td>Started on first day and continued long-term (&gt;1 year) for patients with LVEF &lt;40%, anterior infarcts and diabetes.</td>
</tr>
<tr>
<td></td>
<td>IIb</td>
<td>B</td>
<td>Routine administration in all patients post STEMI &gt; 1 year</td>
</tr>
<tr>
<td>+ ARBs</td>
<td>I</td>
<td>B</td>
<td>Started on first day and continued long-term for patients with LVEF &lt;40%, anterior infarcts and diabetes.</td>
</tr>
<tr>
<td></td>
<td>IIb</td>
<td>B</td>
<td>Routine administration in all patients post STEMI &gt; 1 year</td>
</tr>
<tr>
<td>+ Statins</td>
<td>I</td>
<td>A</td>
<td>Aim for low density lipoprotein-cholesterol (LDL-C) &lt;1.8 mmol/L or a 50% reduction from baseline - the Lower the LDL-C the better.</td>
</tr>
</tbody>
</table>
Important complications following STEMI are arrhythmias and heart failure.

Heart failure may be due to extensive myocardial damage or mechanical complications.

Chest pain post STEMI may be due to:
- Reinfarction/Recurrent MI
- Post infarct angina
- Pericarditis
- Non cardiac causes such as Gastritis
Key Message #9: - Risk Stratification Post STEMI

- All patients post-STEMI should be risk-stratified either clinically or by using the STEMI TIMI and/or GRACE risk scores.

- High-risk patients should be referred to cardiology centres for early coronary angiography and revascularisation.
Patients who present initially to non PCI-capable hospitals should be referred for early coronary angiography with a view to revascularisation in the presence of any of the following:

- Post-infarct angina,
- Inducible ischaemia
- Late ventricular arrhythmias
- In the presence of a depressed LV function (LVEF ≤ 35%) and significant regional wall motion abnormalities
- STEMI TIMI risk score ≥ 6.0
- If symptoms are completely relieved and ST segment completely normalises either spontaneously or after GTN (sublingual or spray) or anti platelet therapy

**Key Message #9: - Risk Stratification Post STEMI**
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<thead>
<tr>
<th>Categories</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>&lt; 65</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>65 - 74</td>
<td>2</td>
</tr>
<tr>
<td></td>
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<td>Yes</td>
<td>2</td>
</tr>
<tr>
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<td>No</td>
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</tr>
<tr>
<td>Anterior ST segment elevation or LBBB</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Diabetes, history of hypertension, history of angina</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Time to treatment &gt; 4 hours</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0</td>
</tr>
</tbody>
</table>

TIMI Risk Score for 30 day mortality:
0 – 14 plausible points
Low and moderate risk:
5 points and below (< 12%)
High-risk:
6 points and above (16-36.0%)
Secondary prevention interventions can reduce mortality and cardiovascular event rate post-STEMI. This includes:

- smoking cessation and other lifestyle changes
- regular exercise
- control of CV risk factors- hypertension, diabetes, smoking, dyslipidaemia
- drug therapy;
  - anti-platelet agents
  - statins therapy
  - β-blockers:
    - < 1 year in all patients
    - >1 year in the presence of LVEF < 40%)
  - ACE-I/ARB:
    - < 1 year in all patients
    - >1 year in the presence of LVEF < 40%, anterior infarct and diabetes)
Key message # 10 : Secondary Prevention Post STEMI

- Healthcare providers should provide patient education and encourage compliance.

- Cardiac rehabilitation is an integral component of secondary prevention.
Diagnosis of STEMI in the elderly, diabetics and women is difficult and a high index of suspicion is important.

Treatment is the same although the elderly and women tend to have higher bleeding risk.

In patients with Chronic Kidney Disease (CKD):
- Treatment of STEMI should be individualised.
- Primary PCI is the preferred reperfusion strategy but morbidity and mortality are high.
- In view of bleeding risks, the dosages of anti-platelet agents and anti-thrombotics need to be adjusted accordingly.
- β-blockers, ACE-I and statins are beneficial in patients with mild to moderate CKD. In patients on dialysis, only β-blockers remain beneficial.
### Key message #12: Fitness for commercial air travel Post STEMI

<table>
<thead>
<tr>
<th>RISK STATUS</th>
<th>DESCRIPTION</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low risk:</strong></td>
<td>▪ age &lt; 65 years,&lt;br&gt;▪ first event,&lt;br&gt;▪ successful reperfusion,&lt;br&gt;▪ LVEF &gt; 45%,&lt;br&gt;▪ no complications,&lt;br&gt;▪ no planned investigations or interventions</td>
<td>Fly after 3 days</td>
</tr>
<tr>
<td><strong>Medium risk</strong></td>
<td>▪ LVEF &gt; 40%,&lt;br&gt;▪ no symptoms of heart failure,&lt;br&gt;▪ no evidence of inducible ischaemia or arrhythmia,&lt;br&gt;▪ no planned investigations or interventions</td>
<td>Fly after 10 days</td>
</tr>
<tr>
<td><strong>High risk:</strong></td>
<td>▪ LVEF ≤ 40%,&lt;br&gt;▪ signs and symptoms of heart failure,&lt;br&gt;▪ those pending further investigation, revascularisation or device therapy</td>
<td>Defer until condition is stable</td>
</tr>
</tbody>
</table>
No unanimous consensus as when to resume driving after STEMI.
In general, for:

**Private drivers:**
- If no Complications and LVEF >35%.
- In the presence of complications:
  - LVEF \( \leq 35\% 
  - acute decompensated heart failure,
  - arrhythmias etc

- it may be longer.
No unanimous consensus as when to resume driving after STEMI. In general, for:

**Commercial Drivers: 3 months if :**

- LVEF $>40\%$. +

- Exercise Stress ECG :
  - Complete Stage 3 of Bruce protocol
  - At the most ST segment depression of 2 mm
<table>
<thead>
<tr>
<th>Indicators for STEMI at presentation</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECG done within 10 minutes of FMC</td>
<td>90%</td>
</tr>
<tr>
<td>FMC to Device time &lt; 90 minutes if in same hospital</td>
<td>60%</td>
</tr>
<tr>
<td>FMC to Device time &lt; 120 minutes if transferred from another hospital</td>
<td>60%</td>
</tr>
<tr>
<td>FMC to needle time &lt; 30 minutes</td>
<td>75%</td>
</tr>
<tr>
<td>Medications at discharge:</td>
<td></td>
</tr>
<tr>
<td>• Aspirin</td>
<td>90%</td>
</tr>
<tr>
<td>• P2 Y12 inhibitors</td>
<td>90%</td>
</tr>
<tr>
<td>• High intensity statins</td>
<td>90%</td>
</tr>
<tr>
<td>If LVEF &lt; 40%)</td>
<td></td>
</tr>
<tr>
<td>• ACE-I/ARB</td>
<td>70%</td>
</tr>
<tr>
<td>• β - blocker</td>
<td>70%</td>
</tr>
<tr>
<td>• MRA</td>
<td>70%</td>
</tr>
<tr>
<td>Cardiac rehabilitation</td>
<td>50%</td>
</tr>
</tbody>
</table>
Key message # 12 : Performance Measures

Outcome Measures indicators include:

- In hospital mortality < 10%
- 30-day mortality < 14%
- 1-year mortality < 18%
M/68 years

Smokes 10 cig a day
Sudden onset “indigestion” like feeling
SOB++
Sweating++
Known Diabetes

Call Ambulance

1030 hours
Severe angina attack?
Chest pain which is retrosternal (below your breastbone) severe, crushing, squeezing or pressing in nature, lasting more than 30 minutes, associated with:

- profuse sweating
- nausea or vomiting
- shortness of breath
- Not relieved by sub-lingual GTN?

You could be having a heart attack! Do not drive!

Call for Help:
Ask for Ambulance Service.

Medical Emergency Coordination Centre MOH

Caller Interrogation process

Online Guide to Take Aspirin

Ambulance Dispatch

Protocol 10: Chest Pain

Assist Medical Officer gives Aspirin

Acute Coronary Syndrome (ACS)

Clinical Pathway for STEMI in PHCAS

MOH CPG on STEMI/ NSTEMI recommends the early provision of Aspirin in ACS (I,A) for immediate antiplatelet effect to limit thrombosis or clot
M/44 years
Smokes 10 cig a day
Sudden onset “indigestion” like feeling
SOB++
Sweating++
Lives in Teluk Intan

Call Ambulance

After 10 mins of “ding – dong”

“Friends put him in the car and take to the nearest clinic”
GP Clinic

2Mm/s 10mV/s V206

Vent. rate 86 BPM
PR interval 148 ms
QRS duration 98 ms
Cart: 1 QT/QTc 380/440 ms
Tech.: P-R-T axes 49 - 27 - 66

Referral by: unconfirmed

X Chest pain
Taken to Nearest Hospital - Non PCI  
Teluk Intan  

(Nearest PCI capable Hospital  90 mins by ambulance)

Chest pain started at 1030  
1130 hours
ONSET OF CHEST PAIN

Ambulance

Travel time: <90 mins

PCI capable centre*
DBT: <90 mins

Time to wire crossing

PCI capable centre*
DBT: <60 mins

Time to wire crossing

Non-PCI capable centre**
Travel time: <60 mins

PCI capable centre*
DBT: <30 mins

Flowchart 2

First Medical Contact

* PCI capable centre: Hub Hospital
** Non-PCI capable centre: Spoke Hospital
*** DIDO: Door In Door Out
DBT: Door to balloon (device) time

If time intervals/transfer times are anticipated to be longer than stated, initiate fibrinolysis first and then consider same day transfer for PCI as part of pharmaco-invasive strategy (3-24 hours post lysis) or for transfer later depending on the clinical condition of the patient and the available resources.
Taken to Nearest Hospital - Non PCI

(Nearest PCI capable Hospital 90 mins by ambulance)

Given Streptokinase
( after quick checklist)

Post Fibrinolysis :Risk assessment

- Pain Free
- BP: 95/70mmHG; HR: 110/min
- ECG – ST still slightly up and developed Q Waves V1-5
- Bedside echo : LVEF:30%
- STEMI TIMI Risk Score
Patients who present initially to non PCI-capable hospitals should be referred for early coronary angiography with a view to revascularisation in the presence of any of the following:

- Post-infarct angina,
- Inducible ischaemia
- Late ventricular arrhythmias
- In the presence of a depressed LV function (LVEF $\leq 35\%$) and significant regional wall motion abnormalities
- STEMI TIMI risk score $\geq 6.0$
- If symptoms are completely relieved and ST segment completely normalises either spontaneously or after GTN (sublingual or spray) or anti platelet therapy
### STEMI TIMI RISK SCORE FOR PREDICTING 30 DAY MORTALITY

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</tr>
</thead>
<tbody>
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</tr>
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</tbody>
</table>

**TIMI Risk Score for 30 day mortality:**
- 0 – 14 plausible points
- **Low and moderate risk:** 5 points and below (< 12%)
- **High-risk:** 6 points and above (16-36.0%)

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<td>Diabetes, history of hypertension,</td>
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<tr>
<td>history of angina</td>
<td>No</td>
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**TIMI Risk Score for 30 day mortality:**

0 – 14 plausible points

Low and moderate risk:
5 points and below (< 12%)

High-risk:
6 points and above (16-36.0%)

**STEMI risk score:** 10

Taken to Nearest Hospital - Non PCI

(Nearest PCI capable Hospital  90 mins by ambulance)

Given Streptokinase
( after quick checklist)

Post Fibrinolysis :Risk assessment

• Pain Free
• BP: 95/70mmHG; HR: 110/min
• ECG – ST still slightly up and developed Q Waves V1-5
• Bedside echo : LVEF:30%
• STEMI TIMI Risk Score

SHOULD BE TRANSFERED ON THE SAME DAY FOR PHARMACO – INVASIVE PCI
Had PCI and Stenting to LAD

Medications At Discharge:

- Aspirin 100 mg daily
- Clopidogrel 75 mg daily
- Perindopril 2 mg daily
- Bisoprolol 1.25 mg daily
- Spironolactone 25 mg daily
- Atorvastatin 40 mg daily
- Metformin 500 mg bid
CLINICAL PRACTICE GUIDELINES

Management of ST Elevation Myocardial Infarction (STEMI) 2019

4th Edition
THANK YOU