Dr FA Snyders
Cardiologist in Private Practice
Life Wilgers Hospital
Pretoria
STEMI as it appears on a coronary angiogram

- Definitive diagnosis made using the angiogram.
- In emergency situations this can be completed in <10 minutes.
• The PPCI treatment involves balloon inflation or thrombus catheter aspiration to open the vessel.

• In most cases a metal scaffold called a stent is implanted to keep the vessel open.
The aim of PPCI is to reopen the previously blocked artery and reestablish anterograde coronary blood flow in infarct related artery.

When normal flow is re-established this is known as TIMI 3 flow.
Symptoms of a heart attack

- **Most typical discomfort/pain zones**
  - Heavy pressure, tightness, crushing pain or unusual discomfort in the centre of the chest
  - This may feel like indigestion, spread to shoulders, arms, neck or jaw and/or last for more than 15 minutes. It may stop or weaken and then return

- **Other possible discomfort/pain zones**
  - Sweating, sickness, faintness or shortness of breath may be experienced
  - There may be a rapid, weak pulse
  - Sharp stabbing pain in the left side of the chest is usually NOT heart pain

http://www.heartfoundation.co.za/how-your-heart-works/symptoms-heart-attack (accessed on 7 Feb 2013)
Ischemic Symptoms - Explained

• Discomfort or Pain in the Center of the Chest that lasts >20 minutes (MI), or that goes away and comes back (Crescendo Angina/UAP).
• Feels like an Uncomfortable Pressure, Squeezing or Burning. It often spreads to the neck/jaw, arms or the abdomen and is not respiratory dependent. Chest pain may also include back pain.
• Sublingual (oral) Nitroglycerine has minimal or no effect.
• Common accompanying symptoms are Nausea, Dizziness, Vomiting, Cold sweat, Anxiety and possibly Dyspnea.

Symptoms in women are often different than in men.
Women are more likely to experience nausea, dizziness, and anxiety.
STEMI ECG
Activate the PPCI pathway immediately the diagnosis is made

Acute anterolateral STEMI
Atypical electrocardiographic presentations

**Bundle branch block**
Criteria that can be used to improve the diagnostic accuracy of STEMI in LBBB:
- Concordant ST-segment elevation ≥1 mm in leads with a positive QRS complex
- Concordant ST-segment depression ≥1 mm in V₁-V₃
- Discordant ST-segment elevation ≥5 mm in leads with a negative QRS complex
The presence of RBBB may confound the diagnosis of STEMI.

**Ventricular paced rhythm**
During RV pacing, the ECG also shows LBBB and the above rules also apply for the diagnosis of myocardial infarction during pacing; however, they are less specific.
**Atypical electrocardiographic presentations cont.**

<table>
<thead>
<tr>
<th>Isolated posterior myocardial infarction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated ST depression ≥0.5 mm in leads V₁–V₃ and ST-segment elevation (≥0.5 mm) in posterior chest wall leads V₇–V₉</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ischaemia due to left main coronary artery occlusion or multivessel disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST depression ≥1 mm in eight or more surface leads, coupled with ST-segment elevation in aVR and/or V₁, suggests left main-, or left main equivalent- coronary obstruction, or severe three vessel ischaemia.</td>
</tr>
</tbody>
</table>
Atypical ECG presentations that deserve prompt management in patients with signs and symptoms of ischemia

- LBBB.
- Ventricular paced rhythm.
- Patients without diagnostic ST-segment elevation but with persistent ischaemic symptoms.
- Isolated posterior myocardial infarction.
- ST-segment elevation in lead aVR.

ECG = electrocardiogram; LBBB = left bundle branch block.
## Initial diagnosis

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECG monitoring</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-lead ECG recording and interpretation is indicated as soon as possible at the point of FMC, with a maximum target delay of 10 min.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>ECG monitoring with defibrillator capacity is indicated as soon as possible in all patients with suspected STEMI.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>The use of additional posterior chest wall leads (V7–V9) in patients with high suspicion of posterior myocardial infarction (circumflex occlusion) should be considered.</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>The use of additional right precordial leads (V3R and V4R) in patients with inferior myocardial infarction should be considered to identify concomitant RV infarction.</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td><strong>Blood sampling</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine blood sampling for serum markers is indicated as soon as possible in the acute phase but should not delay reperfusion treatment.</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

# Recommendation for initial diagnosis

<table>
<thead>
<tr>
<th><strong>Recommendation</strong></th>
<th><strong>Class</strong></th>
<th><strong>Level</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A 12-lead ECG must be obtained as soon as possible at the point of FMC, with a target delay of ( \leq 10 ) min.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>ECG monitoring must be initiated as soon as possible in all patients with suspected STEMI.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Blood sampling for serum markers is recommended routinely in the acute phase but one should not wait for the results before initiating reperfusion treatment.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>The use of additional posterior chest wall leads (V7–V9 ( \geq 0.05 ) mV) in patients with high suspicion of infero-basal myocardial infarction (circumflex occlusion) should be considered.</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Echocardiography may assist in making the diagnosis in uncertain cases but should not delay transfer for angiography.</td>
<td>IIb</td>
<td>C</td>
</tr>
</tbody>
</table>

ECG = electrocardiogram; FMC = first medical contacts; STEMI = ST-segment elevation myocardial infarction.

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215
## Cardiac arrest

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>All medical and paramedical personnel caring for a patient with suspected myocardial infarction must have access to defibrillation equipment and be trained in cardiac life support.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>It is recommended to initiate ECG monitoring at the point of FMC in all patients with suspected myocardial infarction.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Therapeutic hypothermia is indicated early after resuscitation of cardiac arrest patients who are comatose or in deep sedation.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Immediate angiography with a view to primary PCI is recommended in patients with resuscitated cardiac arrest whose ECG shows STEMI.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Immediate angiography with a view to primary PCI should be considered in survivors of cardiac arrest without diagnostic ECG ST-segment elevation but with a high suspicion of ongoing infarction.</td>
<td>IIa</td>
<td>B</td>
</tr>
</tbody>
</table>

ECG = electrocardiogram; FMC = first medical contacts; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

European Heart Journal (2012) 33, 2569–2619
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Reperfusion Therapy Options

• Need to open the blocked vessel as soon as possible either via PCI or Thrombolysis

• **PPCI recommended over fibrinolysis** if performed by an experienced team within 120 minutes of first medical contact

• Longer PCI-delay (DB – DN time) are associated with higher mortality rates and reduced PPCI survival advantage (Pinto D S et al. Circulation 2006;114:2019-2025)

• Often **not a 24 hour service!**

Stone, Circulation, 2008
Relationship Between Mortality Reduction and Extent of Salvage

Time to treatment is critical
Opening the IRA (PCI > lysis)

Impact of time delay - Time is critical!

Modifying factors
- Collaterals
- Ischemic preconditioning
- MVO$_2$
- Stuttering infarction

Mortality reduction (%)

Extent of salvage (% of area at risk)

Hours

0 1 3 6 12 24

0 20 40 60 80 100

Gersh: JAMA, 2005
Time from Symptom Onset to Treatment Predicts 1-year Mortality after Primary PCI

„EVERY MINUTE OF DELAY COUNTS“

The relative risk of 1-year mortality increases by 7.5% for each 30-minute delay

G. De Luca, Circulation 2004
# Reperfusion therapy

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reperfusion therapy is indicated in all patients with symptoms of $&lt;12$ h duration and persistent ST-segment elevation or (presumed) new LBBB.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Reperfusion therapy (preferably primary PCI) is indicated if there is evidence of ongoing ischaemia, even if symptoms may have started $&gt;12$ h beforehand or if pain and ECG changes have been stuttering.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Reperfusion therapy with primary PCI may be considered in stable patients presenting 12-24 h after symptom onset.</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>Routine PCI of a totally occluded artery $&gt;24$ h after symptom onset in stable patients without signs of ischaemia (regardless of whether fibrinolysis was given or not) is not recommended.</td>
<td>III</td>
<td>A</td>
</tr>
</tbody>
</table>

ECG = electrocardiogram; i.v. = intravenous; LBBB = left bundle branch block; PCI = percutaneous coronary intervention.

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215
TIME TO TREAT = DEGREE OF MYOCARDIAL SALVAGE!
What do I do?

• Reperfuse now!
  - Immediate PCI (< 120 mins)  
    OR
  - Thrombolysis (> 120 mins)

• Reperfuse how?
  - Ship immediately to closest cathlab (< 120 mins)  
    OR
  - Drip and then ship to closest cathlab (> 120 mins)

• Reperfuse where?
  - Closest cathlab location
Reperfusion choice depends on time to treatment

Multivariable analysis estimating the treatment effect of reperfusion therapy with PCI or fibrinolysis based on increasing PCI-related delay.

If < 120 min PPCI
If > 120 min Thrombolysis followed by PCI


N= 192 509 pts from 645 National Registry of Myocardial Infarction Hospitals
Prehospital and in-hospital management and reperfusion strategies within 24 h of FMC

STEMI diagnosis

- Primary-PCI capable center
  - Preferably < 60 min
    - Primary-PCI
  - Rescue PCI
    - Immediately
      - No
      - Yes
        - Preferably 3-24 h
          - Coronary angiography
  - EMS or non primary-PCI capable center
    - PCI possible < 120 min?
      - Yes
        - Immediate transfer to PCI center
          - Preferably ≤ 90 min
            - ≤ 60 min in early presenters
      - No
        - Immediate transfer to PCI center
          - Preferably ≤ 30 min
        - Successful fibrinolysis
          - Yes
        - Immediate fibrinolysis
          - No
Difference: thrombolysis and PPCI based strategies

**Lytic strategy**
- Diagnosis based on ECG
- 2/3 eligible
- Not effective in shock
- Of those eligible 50% reach TIMI 3 flow
- Ischaemia and reinfarction common
- Stroke is an important complication
- Cheaper start-up costs
- Easier to organize a service
- Needs support of a rescue PPCI service
- Longer hospital stay for patients
- Definitive care delivered by generalists

**PPCI strategy**
- Diagnosis based on coronary angiogram
- No absolute contraindications
- Reduces mortality by half in shock
- 95% achieve TIMI 3 flow
- Further ischaemia and reinfarction uncommon
- Stroke very rare
- Cost effective in the long-term
- Harder to organize a service
- No rescue PPCI service needed
- Shorter hospital stay for patients
- Definitive care delivered by specialists

Source: courtesy of Prof Rothman and Dr De Palma
Contra-indications to fibrinolytic therapy

<table>
<thead>
<tr>
<th>Absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous intracranial haemorrhage or stroke of unknown origin at anytime.</td>
</tr>
<tr>
<td>Ischaemic stroke in the preceding 6 months.</td>
</tr>
<tr>
<td>Central nervous system damage or neoplasms or arteriovenous malformation.</td>
</tr>
<tr>
<td>Recent major trauma/surgery/head injury (within the preceding month).</td>
</tr>
<tr>
<td>Gastrointestinal bleeding within the past month.</td>
</tr>
<tr>
<td>Known bleeding disorder (excluding menses).</td>
</tr>
<tr>
<td>Aortic dissection.</td>
</tr>
<tr>
<td>Non-compressible punctures in the past 24 hours (e.g. liver biopsy, lumbar puncture).</td>
</tr>
</tbody>
</table>

Contra-indications to fibrinolytic therapy

<table>
<thead>
<tr>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient ischaemic attack in the preceding 6 months.</td>
</tr>
<tr>
<td>Oral anticoagulant therapy.</td>
</tr>
<tr>
<td>Pregnancy or within 1 week postpartum.</td>
</tr>
<tr>
<td>Refractory hypertension (SBP &gt;180 mmHg and/or DBP &gt;110 mmHg).</td>
</tr>
<tr>
<td>Advanced liver disease.</td>
</tr>
<tr>
<td>Infective endocarditis.</td>
</tr>
<tr>
<td>Active peptic ulcer.</td>
</tr>
<tr>
<td>Prolonged or traumatic resuscitation.</td>
</tr>
</tbody>
</table>

Fibrinolytic therapy cont.

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antithrombin co-therapy with fibrinolysis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticoagulation is recommended in STEMI patients treated with lytics until revascularization (if performed) or for the duration of hospital stay up to 8 days. The anticoagulant can be:</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>• Enoxaparin i.v followed by s.c. (using the regimen described below) (preferred over UFH).</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>• UFH given as a weight-adjusted i.v. bolus and infusion.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>In patients treated with streptokinase, fondaparinux i.v. bolus followed by s.c. dose 24 h later.</td>
<td>IIa</td>
<td>B</td>
</tr>
</tbody>
</table>

UFH = unfractionated heparin.

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## Fibrinolytic therapy cont.

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer to a PCI-capable centre following fibrinolysis</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Is indicated in all patients after fibrinolysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interventions following fibrinolysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rescue PCI is indicated immediately when fibrinolysis has failed (&lt; 50 %</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>ST-segment resolution at 60 min).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency PCI is indicated in the case of recurrent ischaemia or evidence</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>of reocclusion after initial successful fibrinolysis.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*European Heart Journal (2012) 33, 2569–2619*  
doi:10.1093/eurheartj/ehs215
Does early thrombolytic therapy affect rate of survival?

Mortality

- Time to treatment
  - <70 min
  - ≥70 min

<table>
<thead>
<tr>
<th>Time to Treatment</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70 min</td>
<td>1.2%</td>
</tr>
<tr>
<td>≥70 min</td>
<td>8.7%</td>
</tr>
</tbody>
</table>

Infarct Size

<table>
<thead>
<tr>
<th>LV (%)</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9%</td>
<td>LV</td>
</tr>
<tr>
<td>11.2%</td>
<td>LV</td>
</tr>
</tbody>
</table>

Ejection Fraction

<table>
<thead>
<tr>
<th>Ejection Fraction</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>49%</td>
<td></td>
</tr>
</tbody>
</table>

Weaver: JAMA, MITI trial, 1993
But what about the risks associated with thrombolysis?

Thrombolysis is highly effective but there is 1% chance of intracranial bleeding.
Tenectaplasase has a lower rate of non cerebral bleeding and easy administration.

**GUSTO 1 (N=41021)**

30-day mortality
- SK + SQH: 7.2%
- SK + IVH: 7.4%
- tPA + IVH: 6.3%
- Combo: 7.0%

**Death or disabling stroke**
- 7.4%

10 deaths +1 stroke /1000 pts treated

**ASSENT 2 (N=16949)**

- Tenectaplasase vs Alteplase
  - 30-day mortality: 6.18% vs 6.15%
  - ICH: 0.93% vs 0.94%
  - Non Cerebral Bleeding: 26.43% vs 28.95%
  - Transfusion: 4.25% vs 5.45%

P=0.0002

P=0.0003
How does success of thrombolysis affect survival rates?

Postlysis TIMI & Survival (Cigarroa. AJC 2004)

Blocked vessel has been opened

Blocked vessel has only been *partially* opened

TIMI 0-1 (20-50%)
So do I wait to check on the success of thrombolysis?

Routine transfer and PCI within 6 hours after lysis

OR

Transfer after 24 hours and elective cath within 2 weeks or urgent transfer for failed lysis (rescue PCI)

(Cantor et al., STREAM study, NEJM 2009)

“Transfer immediately after thrombolysis to PCI centre without awaiting results fibrinolysis”
STREAM Study Conclusions

• Fibrinolysis with bolus tenecteplase and contemporary antithrombotic therapy given before transport to a PCI-capable hospital:
  • Circumvents the need for urgent PCI in about two thirds of fibrinolytic treated STEMI patients
  • Is associated with small increased risk of intracranial bleeding
  • Is as effective as PPCI in STEMI patients within 3 hours symptom onset who cannot undergo PCI within 1 hour of first medic contact

(Cantor et al., STREAM study, NEJM 2009)
# Doses of fibrinolytic agents and antithrombotic co-therapies

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial treatment</th>
<th>Specific contra-indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doses of fibrinolytic therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptokinase</td>
<td>1.5 million units over 30–60 min i.v.</td>
<td>Previous treatment with streptokinase or anistreplase</td>
</tr>
</tbody>
</table>
| Alteplase (tPA)                    | 15 mg i.v. bolus
0.75 mg/kg i.v. over 30 min (up to 50 mg)
then 0.5 mg/kg i.v. over 60 min (up to 35 mg) |                                                                              |
| Reteplase (rPA)                    | 10 units + 10 units i.v. bolus given 30 min apart                                 |                                                                              |
| Tenecteplase (TNK-tPA)             | Single i.v. bolus:
30 mg (6000 IU) if <60 kg
35 mg (7000 IU) if 60 to <70 kg
40 mg (8000 IU) if 70 to <80 kg
45 mg (9000 IU) if 80 to <90 kg
50 mg (10000 IU) if ≥90 kg
It is recommended to reduce to half-dose in patients ≥75 years of age. |                                                                              |
Doses of fibrinolytic agents and antithrombotic co-therapies cont.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial treatment</th>
<th>Specific contra-indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Doses of antiplatelet co-therapies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin</td>
<td>Starting dose of 150–300 mg orally (or 75–250 mg intravenously if oral ingestion is not possible), followed by a maintenance dose of 75–100 mg/day</td>
<td></td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>Loading dose of 300 mg orally, followed by a maintenance dose of 75 mg/day. In patients ≥75 years of age: loading dose of 75 mg, followed by a maintenance dose of 75 mg/day.</td>
<td></td>
</tr>
</tbody>
</table>
Doses of fibrinolytic agents and antithrombotic co-therapies cont.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial treatment</th>
<th>Specific contra-indications</th>
</tr>
</thead>
</table>
| Enoxaparin   | In patients <75 years of age:  
30 mg i.v. bolus followed 15 min later  
by 1 mg/kg s.c. every 12 hours until  
revascularization or hospital discharge for a  
maximum of 8 days. The first two s.c. doses  
should not exceed 100 mg per injection.  
In patients ≥75 years of age:  
no i.v. bolus; start with first s.c. dose of  
0.75 mg/kg with a maximum of 75 mg per injection for the first two s.c. doses.  
In patients with eGFR <30 mL/min/1.73 m², regardless of age, the s.c. doses are given once every 24 hours. |                             |
## Doses of fibrinolytic agents and antithrombotic therapies

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial treatment</th>
<th>Specific contra-indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFH</td>
<td>60 IU/kg i.v. bolus with a maximum of 4000 IU followed by an i.v. infusion of 12 IU/kg with a maximum of 1000 IU/hour for 24-48 hours. Target aPTT: 50-70 s or 1.5 to 2.0 times that of control to be monitored at 3, 6, 12 and 24 hours.</td>
<td></td>
</tr>
<tr>
<td>Fondaparinux (only with streptokinase)</td>
<td>2.5 mg i.v. bolus followed by a s.c. dose of 2.5 mg once daily up to 8 days or hospital discharge.</td>
<td></td>
</tr>
</tbody>
</table>
Thrombolysis (Delayed PCI >120mins)

• What do I administer?
  • European Society of Cardiology recommends:
    • Tenecteplase (fibrinolytic therapy) **within 12h of symptom onset** if PCI cannot be performed within 120 mins of first medical contact
    
    **PLUS**
    
    • Oral/IV aspirin must be administered
    • Clopidogrel

• Ship the patient to nearest cathlab

Immediate PCI (< 120 mins)
Anti-Platelet Agents and Fibrinolytic Therapy

• How and what do I administer *(primary care)*?
  • Starting dose Aspirin 150-500 mg orally or 250mg IV
  • Clopidogrel

• GP IIb/IIIa inhibitors such as Aggrastat (tirofiban) or Integrilin (eptifibatide) *should not be used*

• Ship the patient to the nearest cathlab
## Doses of antithrombotic agents in chronic kidney disease

<table>
<thead>
<tr>
<th>Agent</th>
<th>Normal renal function and stage 1-3 CKD (eGFR ≥30 mL/min/1.73 m²)</th>
<th>Stage 4 CKD (eGFR 15 to &lt;30 mL/min/1.73 m²)</th>
<th>Stage 5 CKD (eGFR &lt;15 mL/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>Loading dose of 150-300 mg orally followed by a maintenance dose of 75-100 mg/day.</td>
<td>No dose adjustment</td>
<td>No dose adjustment</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>Loading dose of 300-600 mg orally followed by 75 mg/day.</td>
<td>No dose adjustment</td>
<td>No information available</td>
</tr>
<tr>
<td>Ticagrelor</td>
<td>Loading dose of 180 mg orally followed 90 mg twice a day.</td>
<td>No dose adjustment</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Prasugrel</td>
<td>Loading dose of 60 mg orally followed by 10 mg/day.</td>
<td>No dose adjustment</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Enoxaparin</td>
<td>1 mg/kg s.c. twice a day, 0.75 mg/kg s.c. twice daily in patients ≥75 years old.</td>
<td>1 mg/kg s.c. once a day</td>
<td>Not recommended</td>
</tr>
</tbody>
</table>

---

### Doses of antithrombotic agents in chronic kidney disease cont.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Normal renal function and stage 1-3 CKD (eGFR ≥30 mL/min/1.73 m²)</th>
<th>Stage 4 CKD (eGFR 15 to &lt;30 mL/min/1.73 m²)</th>
<th>Stage 5 CKD (eGFR &lt;15 mL/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFH</td>
<td><em>Before coronary angiography:</em> Bolus 60-70 IU/kg i.v. (maximum 5000 IU) and infusion (12-15 IU/kg/hour, maximum 1000 IU/hour), target aPTT 1.5-2.5 x control. <em>During PCI:</em> 70-100 IU/kg i.v. (50-70 IU/kg if concomitant with GP IIb/IIIa inhibitors).</td>
<td>No dose adjustment</td>
<td>No dose adjustment</td>
</tr>
<tr>
<td>Fondaparinux</td>
<td>2.5 mg s.c. once a day.</td>
<td>Not recommended if eGFR &lt;20 mL/min/1.73 m² or dialysis.</td>
<td>Not recommended</td>
</tr>
</tbody>
</table>
Doses of antithrombotic agents in chronic kidney disease cont.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Normal renal function and stage 1-3 CKD (eGFR ≥30 mL/min/1.73 m²)</th>
<th>Stage 4 CKD (eGFR 15 to &lt;30 mL/min/1.73 m²)</th>
<th>Stage 5 CKD (eGFR &lt;15 mL/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bivalirudin</td>
<td>Bolus 0.75 mg/kg i.v., infusion 1.75 mg/kg/hour. If eGFR ≥30 and ≤60 mL/min/1.73 m² reduce infusion dose to 1.4 mg/kg/hour.</td>
<td>Not recommended</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Abciximab</td>
<td>Bolus of 0.25 mg/kg i.v. followed by 0.125 μg/kg/min infusion (maximum 10 μg/min).</td>
<td>Careful consideration of bleeding risk.</td>
<td>Careful consideration of bleeding risk.</td>
</tr>
</tbody>
</table>
# Doses of antithrombotic agents in chronic kidney disease cont.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Normal renal function and stage 1-3 CKD (eGFR ≥30 mL/min/1.73 m²)</th>
<th>Stage 4 CKD (eGFR 15 to &lt;30 mL/min/1.73 m²)</th>
<th>Stage 5 CKD (eGFR &lt;15 mL/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eptifibatide</td>
<td>Bolus of 180 μg/kg i.v. followed by an infusion of 2.0 μg/kg/min for up to 18 hours. If eGFR &lt;50 mL/min/1.73 m² reduce infusion dose to 1.0 μg/kg/min.</td>
<td>Not recommended</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Tirofiban</td>
<td>Bolus 25 μg/kg i.v. followed by 0.15 μg/kg/min.</td>
<td>Reduce infusion rate to 50%</td>
<td>Not recommended</td>
</tr>
</tbody>
</table>
# Relief of hypoxaemia and symptoms

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypoxia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen is indicated in patients with hypoxaemia (SaO2 &lt;90% or PaO2 &lt;60 mmHg).</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Routine oxygen is not recommended in patients with SaO2 ≥90%.</td>
<td>III</td>
<td>B</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titrated i.v. opioids should be considered to relieve pain.</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>A mild tranquillizer (usually a benzodiazepine) should be considered in very anxious patients.</td>
<td>IIa</td>
<td>C</td>
</tr>
</tbody>
</table>

### Cardiac arrest

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is indicated that all medical and paramedical personnel caring for suspected myocardial infarction have access to defibrillation equipment and are trained in basic cardiac life support.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Urgent angiography (and PCI if indicated) should be considered in patients with resuscitated cardiac arrest without diagnostic ST-segment elevation but with a high suspicion of ongoing myocardial ischaemia.</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Prehospital cooling using a rapid infusion of large volumes of cold i.v. fluid immediately after return of spontaneous circulation is not recommended.</td>
<td>III</td>
<td>B</td>
</tr>
</tbody>
</table>

**Management of hyperglycaemia**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is recommended to measure glycaemic status at initial evaluation in all patients, and perform frequent monitoring in patients with known diabetes or hyperglycaemia (defined as glucose levels ≥11.1 mmol/L or ≥200 mg/dL).</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>In patients on metformin and/or SGLT2 inhibitors, renal function should be carefully monitored for at least 3 days after coronary angiography/PCI.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Glucose-lowering therapy should be considered in ACS patients with glucose levels &gt;10 mmol/L (&gt;180 mg/dL), while episodes of hypoglycaemia (defined as glucose levels ≤3.9 mmol/L or ≤70 mg/dL) should be avoided.</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Less stringent glucose control should be considered in the acute phase in patients with more advanced cardiovascular disease, older age, longer diabetes duration, and more comorbidities.</td>
<td>IIa</td>
<td>C</td>
</tr>
</tbody>
</table>
Two different STEMI subgroups undergoing PPCI after pre-hospital resuscitation

Initial neurological presentation in 135 consecutive patients with resuscitated cardiac arrest and STEMI (2000-2004)

Conscious on admission
49 (36%)
Mortality 0%

Comatose on admission
86 (64%)
Mortality 43%

What is PPCI?

- PPCI is a mechanical technique used to open up blocked coronary blood vessels that may or may not use stent(s) or other devices.
- Procedure is performed under x-ray guidance and requires specialised skills and team-members.
- More effective in reopening occluded arteries than thrombolysis.
- For both AHA and ESC Primary PCI is a class 1A indication for Acute STEMI if it can be performed within 120 minutes of first medical contact (90 minutes if presenting early with a large infarct and low risk of bleeding complications).
Benefits of PPCI vs Thrombolysis

• Lower in-hospital mortality
• Less complications
• Fewer ambulance journeys
• Reduced unscheduled revascularisation
• Shorter length of stay
• More cost-effective for the healthcare economy
## Primary PCI

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indications for primary PCI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary PCI is the recommended reperfusion therapy over fibrinolysis if</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>performed by an experienced team within 120 min of FMC.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary PCI is indicated for patients with severe acute heart failure or</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>cardiogenic shock, unless the expected PCI related delay is excessive and the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>patient presents early after symptom onset.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FMC = first medical contacts; PCI = percutaneous coronary intervention.
Where is my nearest cathlab in Pretoria & Centurion

Dr George Mukhari
Montana
Eugene Marais
Steve Biko Academic
Pretoria Heart
Wilgers
1 Military
Zuid Afrikaans
Unitas
Components of delay in STEMI and ideal time intervals for intervention

- **Symptom onset**
- **FMC**
- **Diagnosis**
- **Reperfusion therapy**

- **Patient delay**

- **System delay**

- **Time to reperfusion therapy**

- Wire passage in culprit artery if primary PCI

- Bolus or infusion start if thrombolysis

All delays are related to FMC (first medical contact)

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215

120 for life
every minute counts
### Important delays and treatment goals in the management of acute STEMI

<table>
<thead>
<tr>
<th>Delays</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred for FMC to ECG and diagnosis.</td>
<td>≤ 10 min</td>
</tr>
<tr>
<td>Preferred for FMC to fibrinolysis (‘FMC to needle’).</td>
<td>≤ 30 min</td>
</tr>
<tr>
<td>Preferred for FMC to primary PCI (‘door to balloon’) in primary PCI hospitals.</td>
<td>≤ 60 min</td>
</tr>
<tr>
<td>Preferred for FMC to primary PCI.</td>
<td>≤ 90 min (≤ 60 min if early presenter with large area at risk) if this target cannot be met, consider fibrinolysis.</td>
</tr>
<tr>
<td>Acceptable for primary PCI rather than fibrinolysis.</td>
<td>≤ 120 min (≤ 90 min if early presenter with large area at risk) if this target cannot be met, consider fibrinolysis.</td>
</tr>
<tr>
<td>Preferred for successful fibrinolysis to angiography.</td>
<td>3-24 h</td>
</tr>
</tbody>
</table>

FMC = first medical contacts; PCI = percutaneous coronary intervention.
Treatment Choice Conclusions

• During first 2-3 hours after symptom-onset, time to treatment is critical

• After 3 hours, PPCI is preferred if it can be done within 2 hours of first medical contact.

• If not, then a pharmacoinvasive strategy with thrombolysis followed by immediate transfer for PCI within next 3-24 hours may improve myocardial salvage and survival.

• Immediate or ‘rescue’ PCI for failed thrombolysis
Summary of common pitfalls

• Not obtaining a history of cardiac chest pain
• Not performing immediate ECG on all patients triaged as possible cardiac chest pain
• Not performing serial ECG when appropriate
• Repeated ECGs when diagnosis is clear
• Lack of knowledge regarding closest cathlab
• Administering drugs before activating EMS
• Rotating and temporary staff unaware of protocol
• Thrombolytics not being carried on board ambulance
• Lack of beds available at hospital with a cathlab (call to check!)
• Possible medical aid authorisation delays
What is new 2017 Guidelines on AMI-STEMI
2017 New / Revised Concepts

MINOCA AND QUALITY INDICATORS:
• New chapters dedicated to these topics.

STRATEGY SELECTION AND TIME DELAYS:
• Clear definition of first medical contact (FMC).
• Definition of “time 0” to choose reperfusion strategy (i.e. the strategy clock starts at the time of “STEMI diagnosis”).
• Selection of PCI over fibrinolysis: when anticipated delay from “STEMI diagnosis” to wire crossing is ≤120 min.
• Maximum delay time from “STEMI diagnosis” to bolus of fibrinolysis agent is set in 10 min.
• “Door-to-Balloon” term eliminated from guidelines.

TIME LIMITS FOR ROUTINE OPENING OF AN IRA:
• 0-12h (Class I); 12-48h (Class IIa); >48h (Class III).

ELECTROCARDIOGRAM AT PRESENTATION:
• Left and right bundle branch block considered equal for recommending urgent angiography if ischaemic symptoms.

TIME TO ANGIOGRAPHY AFTER FIBRINOLYSIS:
• Timeframe is set in 2-24h after successful fibrinolysis.

PATIENTS TAKING ANTICOAGULANTS:
• Acute and chronic management presented.

# Summary of important time targets

<table>
<thead>
<tr>
<th>Intervals</th>
<th>Time targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum time from FMC to ECG and diagnosis.</td>
<td>( \leq 10 \text{ min} )</td>
</tr>
<tr>
<td>Maximum expected delay from STEMI diagnosis to primary PCI (wire crossing) to choose primary PCI strategy over fibrinolysis (if this target time cannot be met, consider fibrinolysis).</td>
<td>( \leq 120 \text{ min} )</td>
</tr>
<tr>
<td>Maximum time from STEMI diagnosis to wire crossing in patients presenting at primary PCI hospitals.</td>
<td>( \leq 60 \text{ min} )</td>
</tr>
<tr>
<td>Maximum time from STEMI diagnosis to wire crossing in transferred patients.</td>
<td>( \leq 90 \text{ min} )</td>
</tr>
</tbody>
</table>
## Summary of important time targets

<table>
<thead>
<tr>
<th>Intervals</th>
<th>Time targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum time from STEMI diagnosis to bolus or infusion start of fibrinolysis in patients unable to meet primary PCI target times.</td>
<td>≤10 min</td>
</tr>
<tr>
<td>Time delay from start of fibrinolysis to evaluation of its efficacy (success or failure).</td>
<td>60-90 min</td>
</tr>
<tr>
<td>Time delay from start of fibrinolysis to angiography (if fibrinolysis is successful).</td>
<td>2-24 hours</td>
</tr>
</tbody>
</table>
Maximum target times according to reperfusion strategy selection in patients presenting via EMS or in non-PCI Centre

![Strategy clock diagram]

Maximum target times according to reperfusion strategy selection in patients presenting via EMS or in non-PCI Centre

[Diagram showing total ischaemic time through patient delay, EMS delay, system delay, and FMC: EMS, FMC: Non-PCI centre, FMC: PCI centre, STEMI diagnosis, and reperfusion strategies (Wire crossing, Lytic bolus, Primary PCI strategy)].

References:
- muscle for life: 120 every minute counts
# Logistics of pre-hospital care

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulance teams must be trained and equipped to identify STEMI (with use of ECG recorders and telemetry as necessary) and administer initial therapy, including thrombolysis where applicable.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>The prehospital management of STEMI patients must be based on regional networks designed to deliver reperfusion therapy expeditiously and effectively, with efforts made to make primary PCI available to as many patients as possible.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>Primary PCI-capable centres must deliver a 24/7 service and be able to start primary PCI as soon as possible but always within 60 min from the initial call.</td>
<td>I</td>
<td>B</td>
</tr>
</tbody>
</table>

ECG = electrocardiogram; EMC = emergency medical system; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.
## Logistics of pre-hospital care

<table>
<thead>
<tr>
<th>Recommendations</th>
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<th>Level</th>
</tr>
</thead>
</table>
| All hospitals and EMSs participating in the care of patients with STEMI must record and monitor delay times and work to achieve and maintain the following quality targets:  
  - first medical contact to first ECG ≤ 10 min;  
  - first medical contact to reperfusion therapy;  
    - for fibrinolysis ≤ 30 min;  
    - for primary PCI ≤ 90 min (≤ 60 min if the patient presents within 120 min of symptom onset or directly to a PCI-capable hospital). | I     | B     |
| All EMSs, emergency departments, and coronary care units must have a written updated STEMI management protocol, preferably shared within geographic networks. | I     | C     |
| Patients presenting to a non-PCI-capable hospital and awaiting transportation for primary or rescue PCI must be attended in an appropriately monitored area. | I     | C     |
| Patients transferred to a PCI-capable centre for primary PCI should bypass the emergency department and be transferred directly to the catheterization laboratory. | IIa   | B     |

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*European Heart Journal (2012) 33, 2569–2619  
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<table>
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<tr>
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<tbody>
<tr>
<td>All hospitals participating in the care of STEMI patients should have a coronary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>care unit equipped to provide all aspects of care for STEMI patients, including</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>treatment of ischaemia, severe heart failure, arrhythmias and common</td>
<td></td>
<td></td>
</tr>
<tr>
<td>comorbidities.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Length of stay in the coronary care unit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients undergoing uncomplicated successful reperfusion therapy should be</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>kept in the coronary care unit for a minimum of 24 h, after which they may be</td>
<td></td>
<td></td>
</tr>
<tr>
<td>moved to a step-down monitored bed for another 24-48 h.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transfer back to a referring non-PCI hospital</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early transfer (same day) may be considered in selected, low-risk patients</td>
<td>IIb</td>
<td>C</td>
</tr>
<tr>
<td>after successful primary PCI without observed arrhythmia.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hospital discharge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early discharge (after approximately 72 h) is reasonable in selected low-risk</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>patients, if early rehabilitation and adequate follow-up are arranged.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

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## Logistics of prehospital care

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<th>Recommendations</th>
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<tbody>
<tr>
<td>It is recommended that the prehospital management of STEMI patients is based on regional networks designed to deliver reperfusion therapy expeditiously and effectively, with efforts made to make primary PCI available to as many patients as possible.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>It is recommended that primary PCI-capable centres deliver a 24/7 service and are able to perform primary PCI without delay.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>It is recommended that patients transferred to a PCI-capable centre for primary PCI bypass the emergency department and CCU/ICCU and are transferred directly to the catheterization laboratory.</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>It is recommended that ambulance teams are trained and equipped to identify STEMI (with use of ECG recorders and telemetry as necessary) and administer initial therapy, including fibrinolysis when applicable.</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

Logistics of prehospital care cont.

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is recommended that all hospitals and EMS participating in the care of patients with STEMI record and audit delay times and work to achieve and maintain quality targets.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>It is recommended that EMS transfer STEMI patients to a PCI-capable centre, by-passing non-PCI centres.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>It is recommended that EMS, emergency departments, and CCU/ICCU have a written updated STEMI management protocol, preferably shared within geographic networks.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>It is recommended that patients presenting to a non-PCI-capable hospital and awaiting transportation for primary or rescue PCI are attended in an appropriately monitored area (e.g. the emergency department, CCU/ICCU, intermediate care unit).</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

# Definitions of terms related to reperfusion therapy

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMC</td>
<td>The time point when the patient is either initially assessed by a physician, paramedic, nurse or other trained EMS personnel who can obtain and interpret the ECG, and deliver initial interventions (e.g. defibrillation). FMC can be either in the prehospital setting or upon patient arrival at the hospital (e.g. emergency department).</td>
</tr>
<tr>
<td>STEMI diagnosis</td>
<td>The time at which the ECG of a patient with ischaemic symptoms is interpreted as presenting ST-segment elevation or equivalent.</td>
</tr>
<tr>
<td>Primary PCI</td>
<td>Emergent PCI with balloon, stent, or other approved device, performed on the IRA without previous fibrinolytic treatment.</td>
</tr>
</tbody>
</table>
Management of hyperglycemia in the acute phase of STEMI

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of glycaemia is indicated at initial evaluation in all patients,</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>and should be repeated in patients with known diabetes or hyperglycaemia.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plans for optimal outpatient glucose control and secondary prevention must be</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>determined in patients with diabetes before discharge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The goals of glucose control in the acute phase should be to maintain glucose</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>concentrations ≤ 11.0 mmol/L (200 mg/dL) while avoiding falls of glycaemia &lt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 mmol/L (&lt; 90 mg/dL). In some patients, this may require a dose-adjusted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>insulin infusion with monitoring of glucose, as long as hypoglycaemia is</td>
<td></td>
<td></td>
</tr>
<tr>
<td>avoided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A measurement of fasting glucose and HbA1c and, in some cases, a post-</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>discharge oral glucose tolerance test should be considered in patients with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hyperglycaemia but without a history of diabetes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine glucose-insulin-potassium infusion is not indicated.</td>
<td>III</td>
<td>A</td>
</tr>
</tbody>
</table>

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What is a regional PPCI service?

- EMS
- PPCI team
- Healthcare planners
- Patient
- CICU team
- Emergency Rooms
- muscle for life

SA Heart

120 every minute counts
Added benefits

• Networking
• Private Public partnership
• National data
• All ACS to benefit
• NCD Risk Factors to be addressed
• Sharing and Giving can make a difference
Time to reperfusion is critical

Atypical ECG presentations requiring prompt management:
- LBBB
- Ventricular paced rhythm
- Patients without diagnostic ST-segment elevation but with persistent ischaemic symptoms
- Isolated posterior myocardial infarction
- ST-segment elevation in lead AVR

Patient has chest pain

Diagnose with 12 lead ECG immediately (< 10 min)

STEMI diagnosis

Monitor every 10 min if chest pain persists

EMS or non-primary-PCI capable centre

PCI possible in < 120 min?

Immediate transfer to PCI center

For PCI as soon as possible
Preferably ≤ 90 min / ≤ 60 min for early presenters

Primary-PCI

Rescue PCI

Immediately

NO

Coronary angiography

Transfer to PCI centre as soon as possible

Successful Fibrinolysis

Immediate Fibrinolysis “Drip & Ship”

Primary-PCI capable centre

Preferably < 60 min

Primary-PCI

NO

Reference:
- PCI = Percutaneous Coronary Intervention
- STEMI = ST-Segment Elevation Myocardial Infarction

SYMPTOMS OF A HEART ATTACK

Symptoms women are often different than in men. Women are more likely to experience nausea, dizziness, and anxiety.

Most typical discomfort / pain zones

Other possible discomfort / pain zones

Most common sites of pain:

Muscle

Numbness

These may be a rapid, weak pulse

Sharp stabbing pain in the left side of the chest

Usually NOT heart pain

Important Telephone Numbers

082 911 / 10111
Ambulance

This project was made possible by an educational grant from the following companies:

Abbott
Biomet
Boston Scientific
Boehringer Ingelheim
Biotronik
Braun Medical
DEB
IQVIA
Lakemedel
Medtronic
Merck
Mitsubishi
Mylan
Novartis
Otsuka
Sanofi
SciLife
Siemens Healthineers
St. Jude
Stryker
Takeda
Teleflex
ThermoFisher
UnitedHealthcare
USCI
Wright Medical
Zoll
Time to reperfusion is critical

**SA HEART EARLY REPERFUSION PILOT PROJECT**

Muscle

120 for life
every minute counts

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**Primary-PCI**

Patient has chest pain

Preferably < 10 min

Diagnosis with 12 lead ECG

STEMI diagnosis

Medication to administer before primary PCI
- Loading dose Aspirin 150-300 mg orally or 81-150mg IV
- Loading dose Clopidogrel 600mg orally OR Loading dose Prasugrel 60mg orally

EMS or non-primary-PCI capable centre

PCI possible in < 120 min?

**YES**

IMMEDIATELY

Immediate transfer to PCI center

Preferably ≤ 90 min

≤ 60 min for early presenters

Immediate transfer to PCI center

Preferably ≤ 30 min

SUCCESSFUL FIBRINOLYSIS?

Coronary angiography

**NO**

Primary-PCI

Rescue PCI

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**SYMPTOMS OF A HEART ATTACK**

- Most typical discomfort / pain zones
- Other possible discomfort / pain zones

- Heavy pressure, tightness, crushing pain or unusual discomfort in the centre of the chest
- This may feel like indigestion, gas to the shoulders, arms, neck or jaw and/or last for more than 15 minutes. It may stop or worsen and then return.

- Sweating, sadness, lightheadedness or shortness of breath may be experienced
- There may be a rapid, weak pulse

- Sharp stabbing pain in the left side of the chest is usually NOT heart pain

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**Important Telephone Numbers**

1 Military Hospital
(032) 314 0999 | (032) 314 0267

MEDICLINIK Bethesda
(071) 759 0500

LIFE Wilgers
(032) 807 3010

NETCARE Unitas
(032) 677 8800

LIFE Eugene Marais
(032) 234 2777

NETCARE Montana
(032) 233 3600

MEDICLINIK Pretoria Heart
(012) 440 0200

Steve Biko Academic Hospital *
(012) 354 1600

Ambulance

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- **EMS** = Emergency Medical System
- **PCI** = Percutaneous Coronary Intervention
- **STEMI** = ST-Segment Elevation Myocardial Infarction

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**Thrombolysis ABSOLUTE Contra-indications**
- Previous intracranial hemorrhage or stroke of unknown etiology at any time
- Schizophrenia in the preceding 6 months
- Central nervous system damage or encephalitis or encephalopathy
- Recent major trauma/surgery/head injury (within the preceding 3 weeks)
- Gross intracranial bleeding within the past month
- Known bleeding disorder (including varices)
- Aortic dissection
- Non-comparable previous in the past 21 h (e.g. liver biopsy, tumor puncture)

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**Thrombolysis RELATIVE Contra-indications**
- Transient ischaemic attack in the preceding 6 months
- Oral anticoagulant therapy
- Propensity or within 1 week postpartum
- Refractory hypertension (systolic blood pressure > 180 mmHg and/or diastolic blood pressure > 110 mmHg)
- Advanced liver disease
- Infection within 1 month
- Active peptic ulcer
- Previous cerebrovascular ischemia

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This project was made possible by an educational grant by the following companies:

Boehringer Ingelheim
Abbott Vascular

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[Image of a map with marked location and a brief summary of the project's objective]
Mapping Hub and Spoke: Wilgers Hospital

- Secondary: Hospital would send to Wilgers as well as another hospital
- Primary: Almost all patients to be sent to Wilgers
- Alternative: Only if there is no Cardio’s on duty

<table>
<thead>
<tr>
<th>Color</th>
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<tbody>
<tr>
<td>Green</td>
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<tr>
<td></td>
<td>24 Hour Cath Lab</td>
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<td>B Hospitals</td>
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<tr>
<td></td>
<td>09:00-17:00 Cath Lab</td>
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<tr>
<td>Orange</td>
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<tr>
<td></td>
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<tr>
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<td>Non Cath Lab hospitals &gt; 30 mins away</td>
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<tr>
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<td>GP Practice</td>
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<td></td>
<td>Small towns with GP practises &gt; 30 mins away</td>
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<tr>
<td>Purple</td>
<td>GP Practice</td>
</tr>
<tr>
<td></td>
<td>GP Practice &lt; 30 mins away</td>
</tr>
</tbody>
</table>
What can you do to help?

• Know where all your local cathlabs are
• Find out who the cardiologists are
• If you think the patient might have had an MI, perform an ECG
• Take a picture of the ECG with your mobile phone and send it ahead to the cardiologist
• Carry and administer thrombolysis according to the guidelines
• Ask questions if you are unsure
• Do not delay getting your patient to a cathlab
Summary of novel aspects

- Importance of recognizing atypical ECG presentations.
- Immediate angiography with a view to PCI in survivors of cardiac arrest and STEMI or high suspicion of AMI.
- A delay of < 90 min from FMC to P-PCI is the target but a maximum of 120 min is acceptable for primary PCI rather than fibrinolysis.
- Delays must be recorded and monitored:
  - FMC to ECG: \( \leq 10 \) min;
  - FMC to lysis: \( \leq 30 \) min;
  - FMC to PPCI: \( \leq 90 \) min (60 min in PCI hospitals or for early presenters).
- Primary PCI is indicated if there is evidence of ongoing ischaemia, even if symptoms may have started > 12 h.
- After fibrinolysis:
  - Transfer to a PCI-capable center is indicated in all patients;
  - Angio with a view to revascularization indicated after successful lysis (optimal timing 3-24 h).

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215
Summary of novel aspects

- DES preferred over BMS for P-PCI.
- Prasugrel or Ticagrelor preferred over clopidogrel as adjunct to ASA in P-PCI.
- DAPT is recommended for 12 months, with minimum of 1 for BMS, 6 for DES).
- Bivalirudin preferred as anticoagulant for P-PCI, or enoxaparin, over UFH.
- Routine use of GPIIb/IIIa blockers is downgraded in P-PCI.
- β-blockers downgraded after STEMI without CHF or LV dysfunction.
- Guidelines for managing hyperglycemia in the acute phase.
Summary of novel aspects

- Special subsets are emphasized (gender, diabetes, renal failure).
- Minimal CCU (24 h) and hospital LOS (72 h), with early transfer possible.
- After the acute phase:
  - All pts should have an echocardiogram;
  - Stress testing or imaging for viability and ischemia is indicated in pts with MVD.
- High dose statins in all patients without contraindication or history of intolerance.
- LDL target of $\leq 1.8$ mmol/L (0.7 g/dL).
Major gaps in evidence

- Strategies to minimize early cardiac arrest.
- Improving patient and public awareness of STEMI symptoms.
- Optimizing clinical pathways for high-quality, homogeneous early STEMI diagnosis and management.
- Reducing or minimizing myocardial injury and left ventricular dysfunction following STEMI.
- Defining the optimal management strategy for non-culprit vessels in primary PCI patients.
- Defining the optimal long-term antithrombotic regimen in patients receiving stents and who have an indication for oral anticoagulants.
- Defining the role for pre-hospital thrombolysis in patients presenting early.
Major gaps in evidence

- Defining the optimal combination and duration of antithrombotic therapies.
- Defining the optimal glucose-management goals and strategy in patients with known diabetes or acute hyperglycaemia.
- Developing percutaneous techniques for managing ventricular septal defects.
- Effective and safe of cell therapy to replace myocardium or minimize the consequences of myocardial injury.
- Strategy to minimize risk of sudden death in patients with ventricular tachycardia or ventricular fibrillation during or after STEMI.
- Effective strategies to achieve and maintain long-term effective risk factor control.
Questions?

Thank you!