Management of Patients with Acute Myocardial Infarction without ST elevation

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Terminology used in acute coronary syndromes.
Reproduced with permission from Hamm et al. Lancet 2001; 358: 1533–1538
ACS with persistent ST-segment elevation

Adapted from Michael Davies

Troponin elevated

ACS without persistent ST-segment elevation

Adapted from Michael Davies

Troponins elevated or not

ESC Guidelines for the Management of NSTE-ACS (18)
Coronary artery plaque rupture can result in a variety of ischaemic conditions which fall under the overall term of 'acute coronary syndrome' and include unstable angina, non-ST segment elevation MI (NSTEMI) and ST segment elevation MI (STEMI).
Patients labelled as having acute coronary syndrome, but without initial ST elevation, comprise a relatively heterogeneous group-some later proving (on the basis of elevated blood troponin levels) to have suffered an NSTEMI.
Unstable angina can occur as worsening angina or a single episode of 'crescendo' angina, with a high risk of infarction. Features include angina at rest, ↑frequency, ↑duration, and severity of pain (incl. response to GTN).

It may be difficult to distinguish between unstable angina and NSTEMI in the ED.
ACS Risk Scoring

- **TIMI**
  - Age
  - Risk Factors
  - > 1 episode rest pain
  - Cardiac risk markers
  - Use of aspirin
  - Known CAD
  - ST segment deviation

- **PURSUIT**
  - Age, Sex
  - Signs of CCF
  - CCS class in last 6/52
  - ST depression on ECG

- **GRACE**
  - Age
  - Creatinine
  - Cardiac arrest at admission
  - Elevated cardiac markers
  - Heart rate and systolic BP
  - CCF (Killip class)
  - ST segment deviation
<table>
<thead>
<tr>
<th>At Admission (in-hospital/to 6 months)</th>
<th>At Discharge (to 6 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong> 50-59</td>
<td><strong>Cardiac arrest at admission</strong></td>
</tr>
<tr>
<td><strong>HR</strong> 70-89</td>
<td><strong>ST-segment deviation</strong></td>
</tr>
<tr>
<td><strong>SBP</strong> 120-139</td>
<td><strong>Elevated cardiac enzymes/markers</strong></td>
</tr>
<tr>
<td><strong>Creat.</strong> 1.6-1.99</td>
<td></td>
</tr>
<tr>
<td><strong>CHF</strong> III (pulmonary edema)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Probability of</th>
<th>Death</th>
<th>Death or MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital</td>
<td>27%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>To 6 months</td>
<td>30%</td>
<td>70%</td>
<td></td>
</tr>
</tbody>
</table>
Discharge

### ACS Risk Model

**At Admission (in-hospital/to 6 months)**
- **Age**: 40-49
- **HR**: 90-109
- **SBP**: 100-119
- **Creat.**: 2.0-3.99
- **Congestive heart failure**

**At Discharge (to 6 months)**
- **In-hospital PCI**
- **In-hospital CABG**
- **Past history of MI**
- **ST-segment depression**
- **Elevated cardiac enzymes/markers**

**Probability of Discharge to 6 months**
- **Death**: 6%
- **Death or MI**: 9%

[SI Units] [Reset]

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**GRACE Info** | **References** | **Disclaimer**
Mortality in hospital and at 6 months according to the GRACE risk score

<table>
<thead>
<tr>
<th>Risk category (tertile)</th>
<th>GRACE risk score</th>
<th>In-hospital death (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>≤ 108</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Intermediate</td>
<td>109-140</td>
<td>1-3</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 140</td>
<td>&gt; 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk category (tertile)</th>
<th>GRACE risk score</th>
<th>Post-discharge to 6-month death (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>≤ 88</td>
<td>&lt; 3</td>
</tr>
<tr>
<td>Intermediate</td>
<td>89-118</td>
<td>3-8</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 118</td>
<td>&gt; 8</td>
</tr>
</tbody>
</table>
Algorithm for management of pts with suspected AMI in the ED
Chest pain pattern suggesting an acute coronary syndrome

Goal = 10 minutes

- Triage for rapid care
- Aspirin 160-325 mg chewed
- SL nitroglycerin 0.4 mg every 5 minutes for three doses
- Morphine sulfate 2 to 4 mg IV initially, then 2 to 8 mg IV every 5 to 15 minutes
- Establish intravenous access
- Obtain blood for initial laboratory work including serum biomarkers*
- Institute continuous ECG monitoring
- Initiate supplemental oxygen therapy
- Obtain focused history and examination

Initial 12 lead ECG; if not diagnostic, repeat at 5 to 10 minute intervals

- ST elevation or new or presumably new LBBB
- Strong suspicion for ischemia, but no persistent ST elevation
- Normal or nondiagnostic ECG and normal cardiac enzymes
Initial 12 lead ECG; if not diagnostic, repeat at 5 to 10 minute intervals

**ST elevation or new or presumably new LBBB**
- Beta blocker if not contraindicated
- IV nitroglycerin if persistent chest pain
- Intravenous heparin
- Most use GP IIb/IIIa inhibitor if primary PCI
- Clopidogrel

**Strong suspicion for ischemia, but no persistent ST elevation**
- Enoxaparin or unfractionated heparin
- Beta blocker if not contraindicated
- IV nitroglycerin if persistent chest pain
- Clopidogrel but, if PCI is planned, some wait until coronary angiography to see if CABG is required

**Normal or nondiagnostic ECG and normal cardiac enzymes**
- Continue evaluation and treatment in ED or monitored bed
- Repeat ECG and cardiac enzymes at 6 to 12 hours

**Evidence of ischemia/infarction**
- No
  - Perform stress test
- Yes
  - Treat for non-ST elevation acute coronary syndrome

Primary PCI, if available, with goal less than 90 minutes OR thrombolysis with goal of 30 minutes

Look for high-risk features:
- ST depression
- Elevated cardiac enzymes
- Persistent chest pain
- Hemodynamic instability
- TIMI risk score ≥3
1. First Contact

2. Diagnosis / Risk Assessment

3. Invasive Strategy

Otherdiagnosis

Initial Evaluation
- Quality of chest pain
- Symptom-oriented physical examination
- Likelihood of CAD
- Electrocardiogram (ST elevation or other abnormalities)

Validation
- Response to antianginal treatment
- Routine biochemistry, including troponins (on presentation and after 0 to 12 hours), plus special markers (e.g., D-dimers, BNP (NT-proBNP))
- Repeat or continuous ST segment monitoring
- Risk score assessment
- Bleeding risk assessment
- Differential diagnosis exclusion: echocardiogram, CT, MRI, nuclear imaging

ACS possible

Early (< 72 hrs)
- Elevated troponin levels
- Dynamic ST or T wave changes (symptomatic or silent)
- Diabetic mellitus
- Renal dysfunction (GFR < 60 mL/min/1.73 m²)
- Reduced left ventricular function (%LVEF < 40%)
- Earlypost-infarction angina
- Prior MI
- PCI within 6 months
- Prior CABG
- Intermediate to high GRACE risk score

Stable/ elective
- No recurrence of chest pain
- No signs of heart failure
- No new ECG changes (Arrival and at 6 - 12 hours)
- No elevation of troponins (Arrival and at 6 - 12 hours)

STEMI
Initial Evaluation

- Quality of chest pain
- Symptom-oriented physical examination
- Likelihood of CAD
- Electrocardiogram (ST-elevation or other abnormalities)

ACS possible
Otherdiagnosis

Initial Evaluation
- Quality of chest pain
- Symptom-oriented physical examination
- Likelihood of CAD
- Electrocardiogram (ST-elevation or other abnormalities)

ACS possible

Validation
- Response to antianginal treatment
- Routine biochemistry, including troponins (on presentation and after 6 to 12 hours), non-specific markers (e.g., D-dimers, BNP / pro-BNP)
- Repeat or continuous ST segment monitoring
- Risk score assessment
- Bleeding risk assessment
- Differential diagnosis exclusion: ECG, CT, MRI, nuclear imaging

Early (< 72 hrs)
- Elevated troponin levels
- Dynamic ST or T wave changes (symptomatic or silent)
- Diabetic nephropathy
- Renal dysfunction (GFR < 60 ml/min/1.73 m²)
- Reduced left ventricular function (EF < 40%)
- Early post-infarction angina
- Prior MI
- PCI within 6 months
- Prior CABG
- Intermediate to high GRACE risk score

Urgent
- Persistent or recurrent angina with or without ST changes (≥ 2 mm) or deep negative T resistant to antianginal treatment
- Clinical symptoms of heart failure or progressing haemodynamic instability
- Life-threatening arrhythmias (VF, VT)

No / elective
- No recurrence of chest pain
- No signs of heart failure
- No new ECG changes (Arrival and at 6 – 12 hours)
- No elevation of troponins (Arrival and at 6 – 12 hours)

STEMI

1. First Contact
2. Diagnosis / Risk Assessment
3. Invasive Strategy
**Validation**

- Response to antianginal treatment
- Routine biochemistry, including troponins (on presentation and after 6 to 12 hours), e.g., D-dimers, BNP/NT-proBNP
- Repeat or continuous ST segment monitoring
- Risk score assessment
- Bleeding risk assessment
- Differential diagnosis exclusion: echocardiogram, CT, MRI, nuclear imaging.
Otherdiagnosis

**Initial Evaluation**
- Quality of chest pain
- Symptom-oriented physical examination
- Likelihood of CAD
- Electrocardiogram (ST-elevation or other abnormalities)

**Validation**
- Response to antianginal treatment
- Routine biochemistry, including troponins (on presentation and after 6 to 12 hours), poss. special markers (e.g., D-dimers, BNP / NT-proBNP)
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**ACS possible**

**STEMI**

**Early (< 72 hrs)**
- Elevated troponin levels
- Dynamic ST or T wave changes
- Symptomatic or silent
- Diabetic mellitus
- Renal dysfunction (GFR < 60 mL/min/1.73 m²)
- Reduced left ventricular function (EF < 40%)
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- Prior MI
- PCI within 6 months
- Prior CABG
- Intermediate to high GRACE risk score

**No / elective**
- No recurrence of chest pain
- No signs of heart failure
- No new ECG changes
  - Arrival and at 6 – 12 hours
- No elevation of troponins
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**Urgent**
- Persistent or recurrent angina with / without ST changes (≥ 2 mm) or deep neg. T resistant to antianginal treatment
- Clinical symptoms of heart failure or progressing haemodynamic instability
- Life threatening arrhythmias (VF, VT)
Assessment

3. Invasive Strategy

- Persistent or recurrent angina with / without ST changes (≥ 2 mm) or deep negative T wave resistant to antianginal treatment
- Clinical symptoms of heart failure or progressing haemodynamic instability
- Life-threatening arrhythmias (VF, VT)
- Elevated troponin levels
- Dynamic ST or T wave changes
  (symptomatic or silent)
- Diabetes mellitus
- Renal dysfunction (GFR < 60 mL/min/1.73 m²)
- Reduced left ventricular function (EF < 40%)
- Early post-infarction angina
- Prior MI
- PCI within 6 months
- Prior CABG
- Intermediate to high GRACE risk score

early
(< 72 hrs)
Elective

- No recurrence of chest pain
- No signs of heart failure
- No new ECG changes
  (Arrival and at 6 – 12 hours)
- No elevation of troponins
  (Arrival and at 6 – 12 hours)
1. First Contact
2. Diagnosis / Risk Assessment
3. Invasive Strategy

Other Diagnosis

Initial Evaluation
- Quality of chest pain
- Symptom-oriented physical examination
- Likelihood of CAD
- Electrocardiogram (ST-elevation or other abnormalities)

ACS possible

Validation
- Response to antianginal treatment
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