Adult Acute Myocardial Infarction
Preclinical stable CAD Acute Coronary Syndrome

- Ischemia
- Injury
- Cell death

No cardiac enzyme elevation

Cardiac enzyme elevation

UA NSTEMI STEMI
Definition of Coronary Artery Disease

CAD

IHD

Acute coronary syndrome

All patients with coronary artery atherosclerosis

Cardiac disease as a result of myocardial ischemia (imbalance between oxygen requirements and supply)

1. Unstable angina
2. Non-ST elevation MI
3. ST elevation MI
Clinical Presentation of ACS

Classical Angina
Unstable angina
Angina equivalent
  - dyspnea (LV failure)
  - arrhythmia, faint, tiredness
Acute myocardial infarction
Atypical chest pain
  - musculoskeletal, pleuritic features etc
Unstable Angina

Rest Angina
New-onset Angina
Increasing Angina

Occurrence of angina
♦ Class I : Strenuous, rapid or prolonged exercise
♦ Class II : Slight limitation of ordinary activity
♦ Class III : Mark limitation of ordinary physical activity
♦ Class IV : At rest
Definition of AMI

Necrosis of a portion of heart muscle due to inadequate blood supply

Diagnosis:

Clinical Investigations
Complications of UA, AMI

Evolving AMI

Congestive heart failure

Malignant arrhythmia

bradyarrhythmia, tachyarrhythmia

Pulmonary edema

Cardiogenic shock
The first healthcare providers to encounter the ACS pt can have a big impact on pt’s outcome
Reduce myocardial necrosis

Prevent and treat major complications
e.g. VF, VT, pulm edema, shock, unstable bradyarrhythmia or tachyarrhythmia

Reduce subsequent heart failure, death
first healthcare providers can ensure:

- Efficient risk stratification
- Initial stabilization
- BCLS, ACLS if necessary
- Referral for immediate cardiology care
Diagnosis of AMI

Typical history
Suggestive ECG changes
Positive biomakers
Others e.g. Cardiac Imagings
Based on history

Pain > 15 minutes
Crushing, chocking, tight; substernal
Unrelieved by rest or nitroglycerin
Radiation to arms, neck, back, jaw, epigastrium
Associated sighs: diaphoresis, shortness of breath, anxiety
Feeling of impending doom, death
Pain > 15 mins
crushing, tight
Unrelieved by rest or GTN
Radiation of pain
Associated signs:
diaphoresis, shortness of breath, anxiety, impending doom
Based on ECG

“Normal” ECG does not rule out AMI

When in doubt, repeat the ECG 15 min to 30 min later

2 adjacent leads with > 1mm ST segment elevation, or new LBBB ( STEMI )

ST depression > 0.5 mm or dynamic T inversion ( UA or NSTEMI )
Pts with normal or non-diagnostic ECG with symptoms of ACS usually are at low risk or intermediate risk.

Aims: to risk stratify with diagnostic tests and to provide appropriate Rx e.g. cardiac biomarkers, TMX, stress echo, sestaMIBI scan.
Based on biomarkers

Cardiac enzymes e.g. CK-MB, troponin T or I

Insensitive during the first 4-6 hrs of presentation. Hence may need serial testing

Troponin elevation correlates with increased risk of adverse outcome, increased thrombus burden & microvascular embolization, increased risk of death
As it takes time for biomarkers to appear, an early, normal level does not exclude AMI

<table>
<thead>
<tr>
<th>Extent of infarction</th>
<th>Time after onset</th>
<th>Onset</th>
<th>&lt;20-40 min</th>
<th>30 min</th>
<th>1 hour</th>
<th>2 hours</th>
<th>4 hours</th>
<th>6 hours</th>
<th>24 hours</th>
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<tbody>
<tr>
<td>0%</td>
<td></td>
<td></td>
<td>10%</td>
<td>30%</td>
<td>50%</td>
<td>70%</td>
<td>90%</td>
<td>100%</td>
<td></td>
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B. When Serum Markers Are First Detectable (Hours)*
- Myoglobin (1-4 h)
- Cardiac troponins (3-12 h)
- CK-MB (3-12 h)
- CK-MB isoforms (2-6 h)
Action in Emergency Department (soon)

Chest x-ray

Blood studies

(e.g. electrolytes, cardiac enzymes, renal function, coagulation studies)

Avoid arterial punctures
Pts with STEMI usually have complete occlusion of an epicardial coronary artery.

Mainstay of treatment is reperfusion Rx fibrinolytics, or primary PCI.

Aims: rapidly identify pts with STEMI, quickly screen them for indications or contraindications for reperfusion therapy.
Thrombolytic Agents

• Currently available
  - Streptokinase
  - Recombinant tissue plasminogen activator (r-TPA)
  - APSAC (anisoylated plasminogen-streptokinase activator complex)
Eligibility Criteria for Thrombolytic Therapy

Contraindications

Active internal bleeding
Suspected aortic dissection
Significant head injury within 3 months
Intracranial neoplasm or hemorrhage or AVM
Stroke < 3 months
History bleeding diathesis
Eligibility Criteria for Thrombolytic Therapy

Relative Contraindications

Recent trauma or major surgery < 3 months
Traumatic or prolonged (>10 mins) CPR
Pregnancy
Severe HT (BP >180/110 mmHg)
Recent internal bleeding > 1 month
Active peptic ulcer disease
Stroke > 3 months
Current use of warfarin
Significant liver or renal dysfunction
Pts with UA or NSTEMI usually have critical but incomplete occlusion of an epicardial coronary artery

Mainstay of treatment is not fibrinolysis,

But optimized medical therapy, or early invasive strategies
Symptoms & signs of ACS

12 lead ECG

ST elevation
- > 0.1 mV in > 2 adjacent limb leads
- > 0.2 mV in > 2 adjacent chest limbs

Other or normal ECG

Raised cardiac enzymes + ve

STEMI

NSTEMI

Normal cardiac enzymes - ve

UAP
Symptoms & signs of ACS & suggestive ECG

Pain Rx: nitrate, morphine
Antiplatelets Rx

STEMI

Thrombolysis
Sx < 3 hrs & PCI delay > 60 mins
No contraindication & PCI delay > 90 mins

NSTEMI / UAP

PC I
Sx < 3 hrs & PCI delay < 60 mins
Sx > 3 hrs & PCI delay < 90 mins
Cardiogenic shock within 36 hrs

Early invasive

Delayed invasive, or conservative

heparin
heparin Gp IIb/IIIa
heparin Gp IIb/IIIa
heparin Gp lib/IIIa
Initial general therapy (1)

M Morphine
O Oxygen
N Nitrates (S/L, aerosol spray, I.V.)
A Aspirin
Initial general therapy (2)

Clopidogrel
b-blockers
Heparin (unfractionated, low-molecular-weight)
Glpcoprotein IIb / IIla
Calcium channel blockers
ACE inhibitors
Statins
Initial general therapy (3)

Management of rhythm disturbances

VT, VF
Asystole, heart blocks
Bradyarrhythmia
Tachyarrhythmia
  narrow complex
  broad complex
Diagnosis of Atrial Arrhythmia & Management of Narrow Complex Tachycardia
Atrial Ectopics

**Diagnostic features:**

- Usually earlier than normal (i.e., premature)
- P wave morphology different from sinus P. May be lost or deform preceding T wave
- PR interval may be short or long
- QRS usually normal unless aberrantly conducted
- When early may be blocked - blocked atrial ectopic

**Assessment:**

- Symptomatic?
- Associated AF
- Underlying heart disease
- Respiratory disease
- Usually no treatment necessary
Sinus Arrhythmia

Rate: Usually 60-100 beats/min but may be faster or slower
Rhythm: IRREGULAR
P waves: Uniform and upright in appearance
One preceding each QRS complex
PRI: .12 - .20 sec
QRS: <.10
Junctional Rhythm

- Rate is slower than sinus rhythm
- Rhythm is regular
- No preceding P wave
- Infrequently P wave may precede or be just after the QRS (The P waves are inverted in II, III, aVF)
- QRS usually narrow unless aberrantly conducted
Tachycardia

Regular

Narrow Complex

Sinus Tachycardia or PSVT or Atrial Flutter

Broad Complex

Ventricular Tachycardia or SVT with Aberrancy or Preexcitation

Irregular

Narrow Complex

Atrial Fibrillation or Atrial Flutter with varying Block or Multifocal AT

Broad Complex

Polymorphic VT or Torsade De Pointes or Preexited AF
Sinus Tachycardia

Rate: 100-160 beats/min
Rhythm: Regular
P waves: Uniform and upright in appearance
One preceding each QRS complex
PRI: 0.12 - 0.20 sec
QRS: <.10
Sinus Tachycardia
Symptoms and Treatment

❤ Pain - analgesia

❤ Anxiety - sedation

❤ Hyperdynamic state - β blockade

❤ Hypovolemia - volume replacement

❤ Extensive myocardial damage - hemodynamic monitoring and drug therapy
Paroxysmal Supraventricular Tachycardia
Supraventricular Tachycardia

Rate : 150 - 250 / min

Rhythm : Regular

P waves : Atrial P waves differ from sinus P waves
P waves are usually identifiable at the lower end of
the rate range but seldom identifiable at rates > 200
May be lost in preceding T wave

PRI : Usually not measurable because the P wave is
difficult to distinguish from the preceding T wave; if
measurable, is .12-.20

QRS : <..10 sec
WPW paths & associated rhythms

FIG. 65-34. WPW paths and associated rhythms. (From Watanabe Y, Dreifus LS: Cardiac arrhythmias. New York, 1977, Grune & Stratton.)
Atrial Flutter

Rate: Atrial rate 250 - 350 / min
     Ventricular rate variable
Rhythm: Atrial rhythm regular
        Ventricular rhythm usually regular but may be irregular
P waves: Saw-toothed, “flutter waves”
PRI: Not measurable
QRS: Usually <..10 but may be widened if flutter waves are buried in the QRS complex
Atrial Flutter

- Flutter - saw tooth P waves
- Flutter rate usually about 300/min
- Best seen in II, III, aVF
- Ventricular rate usually 150/min with 2:1 AV block
- Rarely 1:1 or higher degree AV block (3:1, 4:1)
Tachycardia

Regular

Narrow Complex
- Sinus Tachycardia or PSVT or Atrial Flutter
- Ventricular Tachycardia or SVT with Aberrancy or Preexcitation

Broad Complex
- Atrial Fibrillation or Atrial Flutter with varying Block or Multifocal AT
- Polymorphic VT or Torsade De Pointes or Preexcited AF

Irregular

Narrow Complex

Broad Complex
Three Variations of Atrial Fibrillation

Atrial Fibrillation

Atrial Fibrillation With Slow Ventricular Response

Atrial Fibrillation With Regular Ventricular Response
Atrial Fibrillation

- Absent P waves
- Chaotic irregular baseline - fibrillatory waves
- Irregularly irregular RR cycles - fast or slow AF
- Wide QRS due to aberrancy may occur intermittently (Ashman’s phenomenon)
MULTIFOCAL ATRIAL TACHYCARDIA

Lead V1

Narrow Complex Tachycardia Algorithm

♥ Step 1 : Access the patient

♥ Step 2 : Identify the arrhythmia

♥ Step 3 : Treat the arrhythmia
Assess the patient for Serious Signs and Symptoms

- Chest pain / AMI
- Shortness of breath / CHF
- Hypotension
- Decreased level of consciousness
- Shock
Treatment

Unstable ➔ Synchronised Cardioversion
100 J, 200 J, 300 J, 360 J
SVT and Atrial Flutter start with 50 J

Stable
• Valsalva maneuver
• Carotid sinus massage
• Drugs
**Narrow Complex Tachycardia**

- **Atrial fibrillation**
  - Atrial flutter
  - Use rate controlled drugs eg: amiodarone, Diltiazem, Verapamil or Digoxin. Consider anti-coagulation/aspirin

- **Paroxysmal supraventricular tachycardia (PSVT)**
  - Vagal maneuvers
  - * Adenosine 6 mg rapid IV push
  - * Adenosine 12mg rapid iv push
  - * Verapamil 1mg / min (up to max 20 mg)

* either drug depending on availability and experience