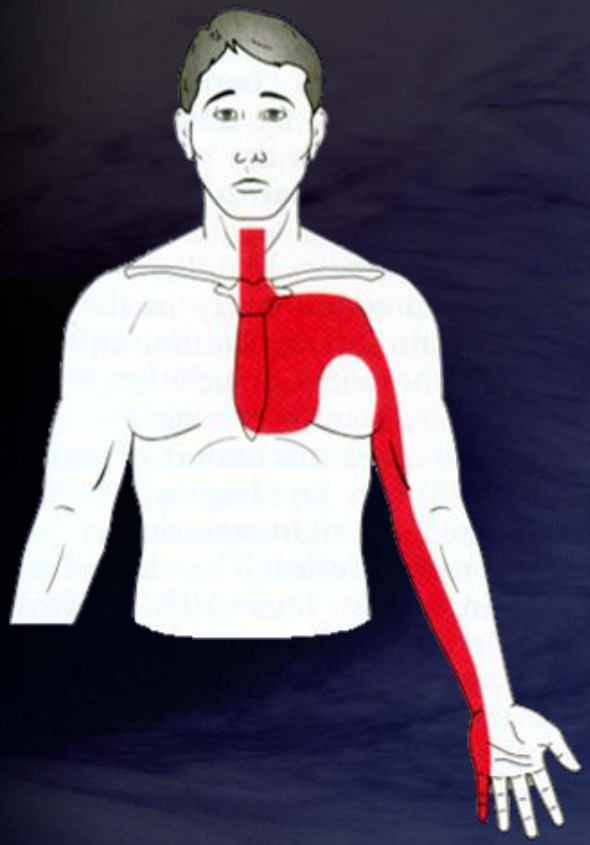
Acute Coronary Syndrome

Clinical Manifestation of CAD

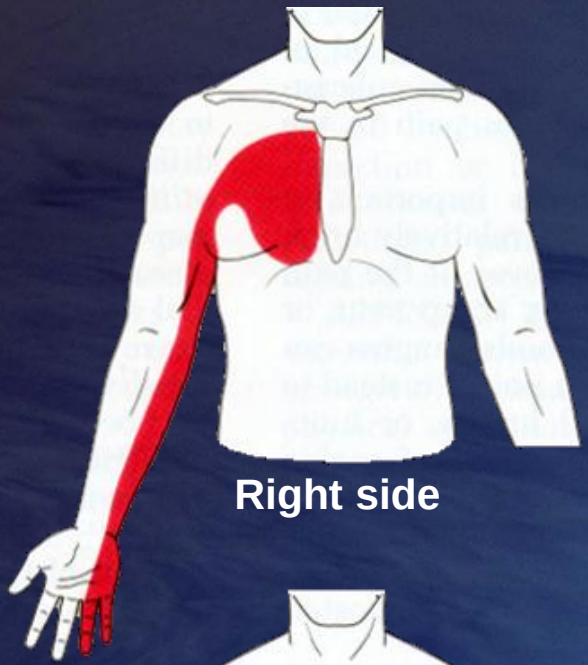
- Silent Ischemia/asymptomatic
- Stable Angina
- Acute Coronary Syndrome *(Non-STEMI/UA and STEMI)*
- Arrhythmias
- Heart Failure
- Sudden Death

Pain patterns with myocardial ischemia

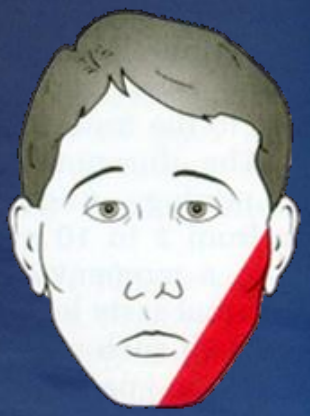
Usual distribution of pain with myocardial ischemia



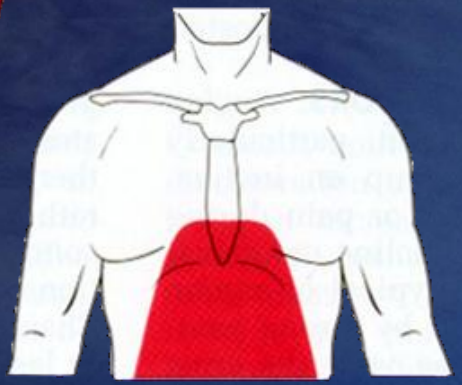
Less common sites of pain with myocardial ischemia



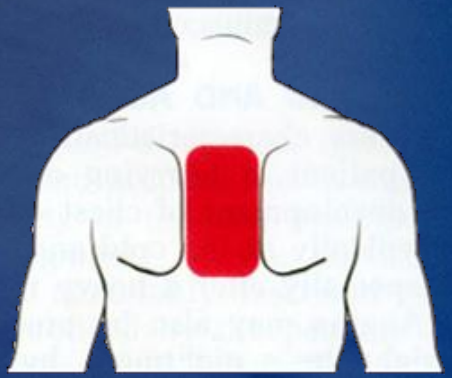
Right side



Jaw



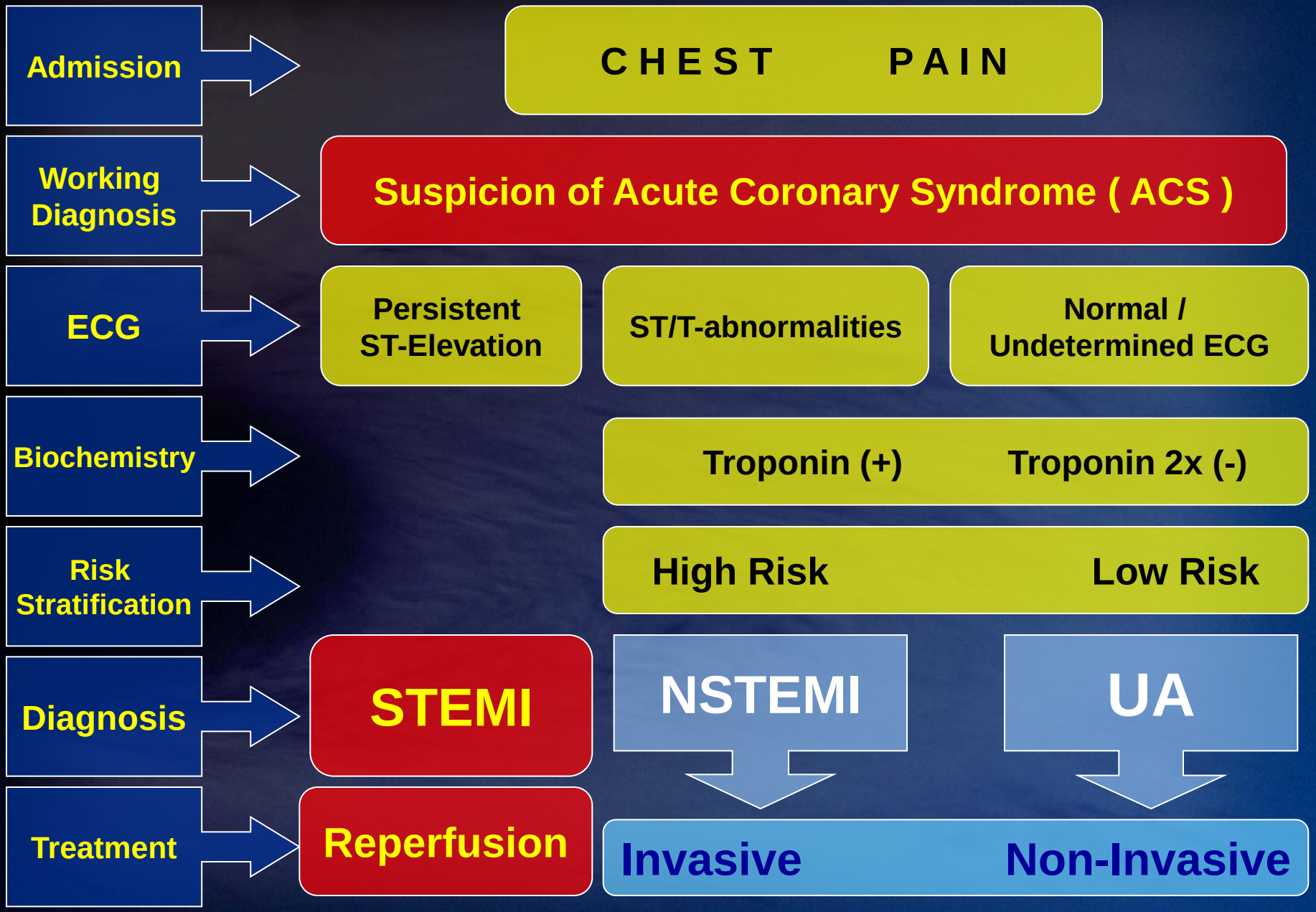
Epigastrium



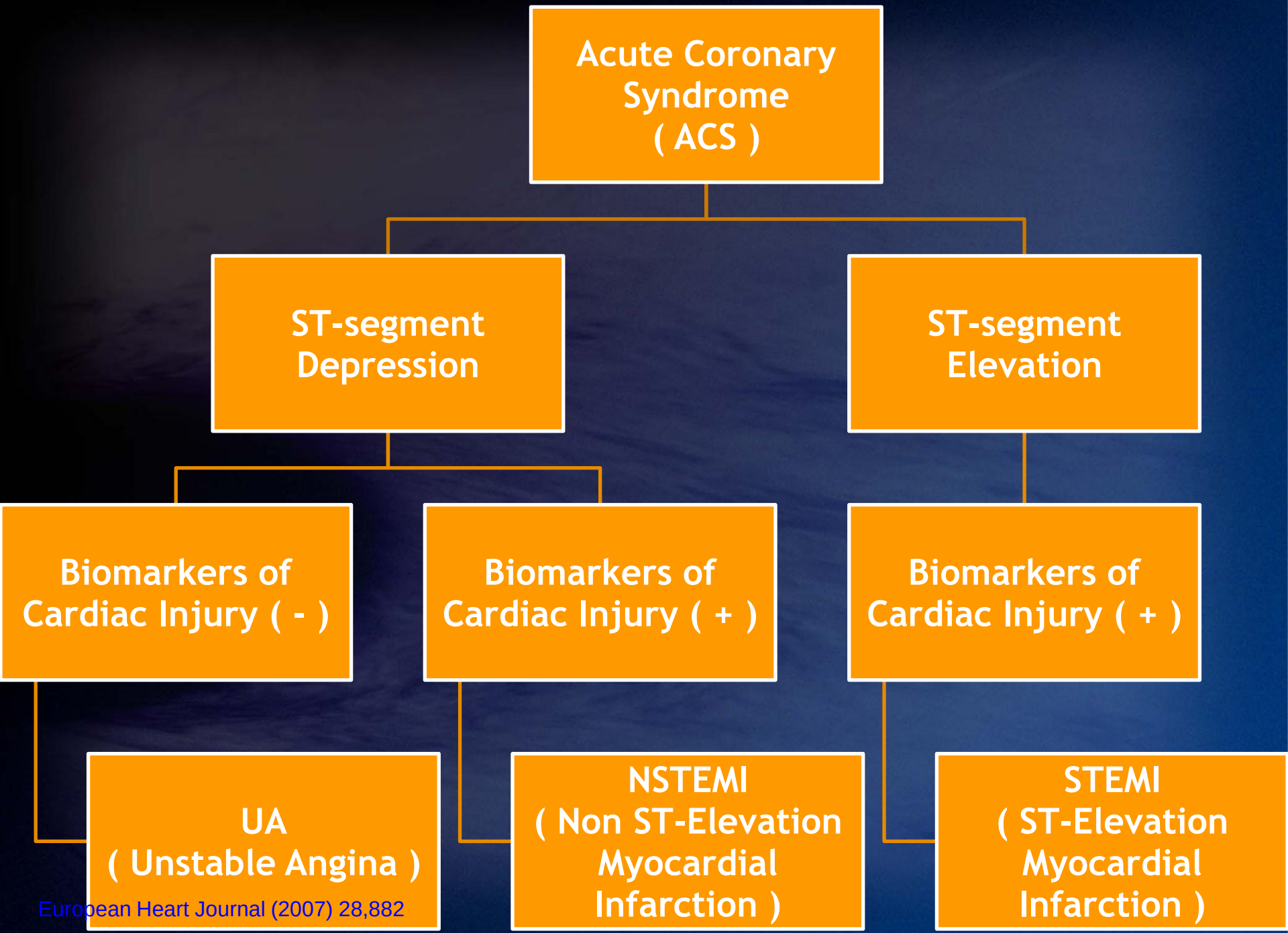
Back

Clinical presentation of ACS

- Prolonged (>20 min) anginal pain at rest
- New onset (de novo) severe angina (CCS class III)
- Recent destabilization of previously stable angina with at least CCS III (crescendo angina) or
- Post MI angina



Guideline for the diagnosis and treatment of NSTEMI ACS, ESC Guidelines June 14th, 2007

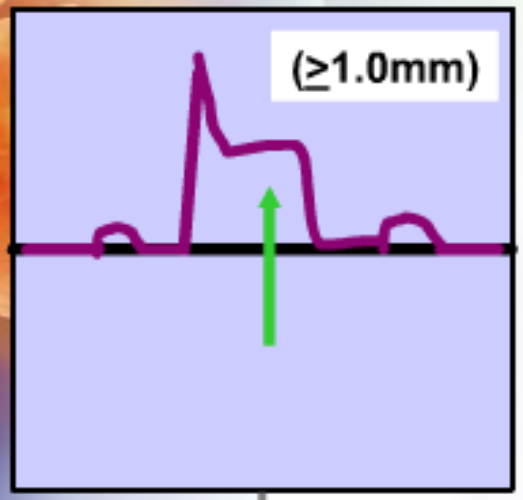


European Heart Journal (2007) 28,882

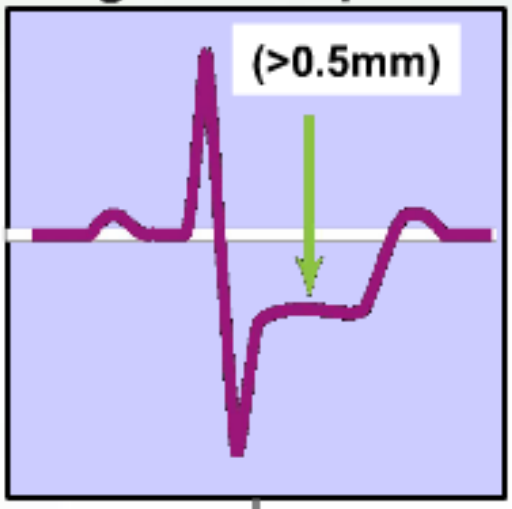
ACS Assessment

May be normal ECG or other ischemic changes

ST-Segment Elevation

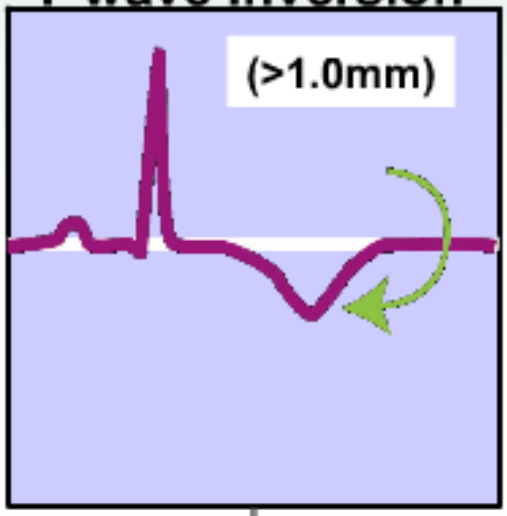


ST-Segment Depression



&/or

T-wave Inversion



ST-segment elevation myocardial infarction

Elevated cardiac markers

Suspect non-ST-segment elevation ACS

Normal cardiac markers

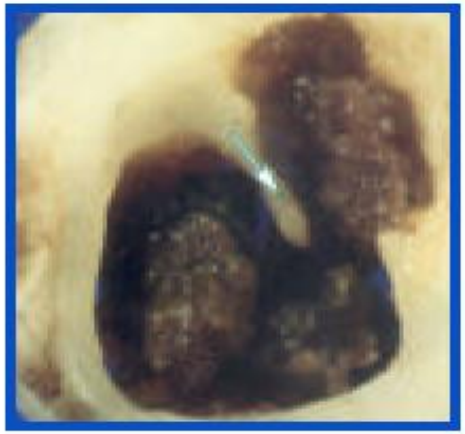
Unstable angina

Elevated cardiac markers

Non-ST-segment elevation myocardial infarction

PATHOPHYSIOLOGY

ACS with Persistent St-segment Elevation

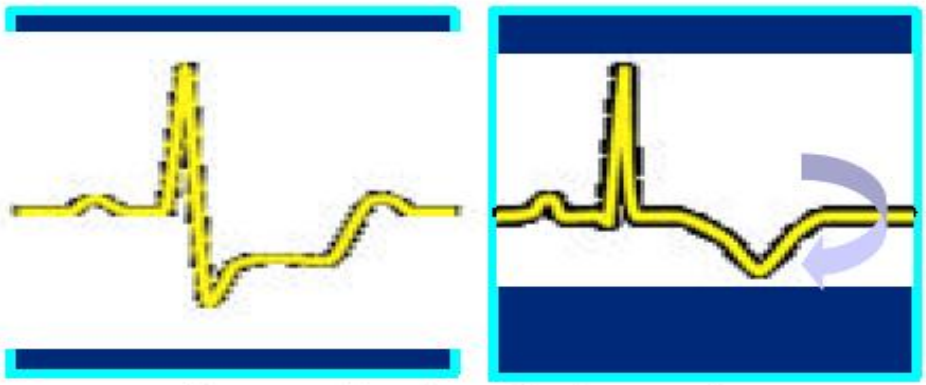


Adapted from Michael Davies

Troponin elevated

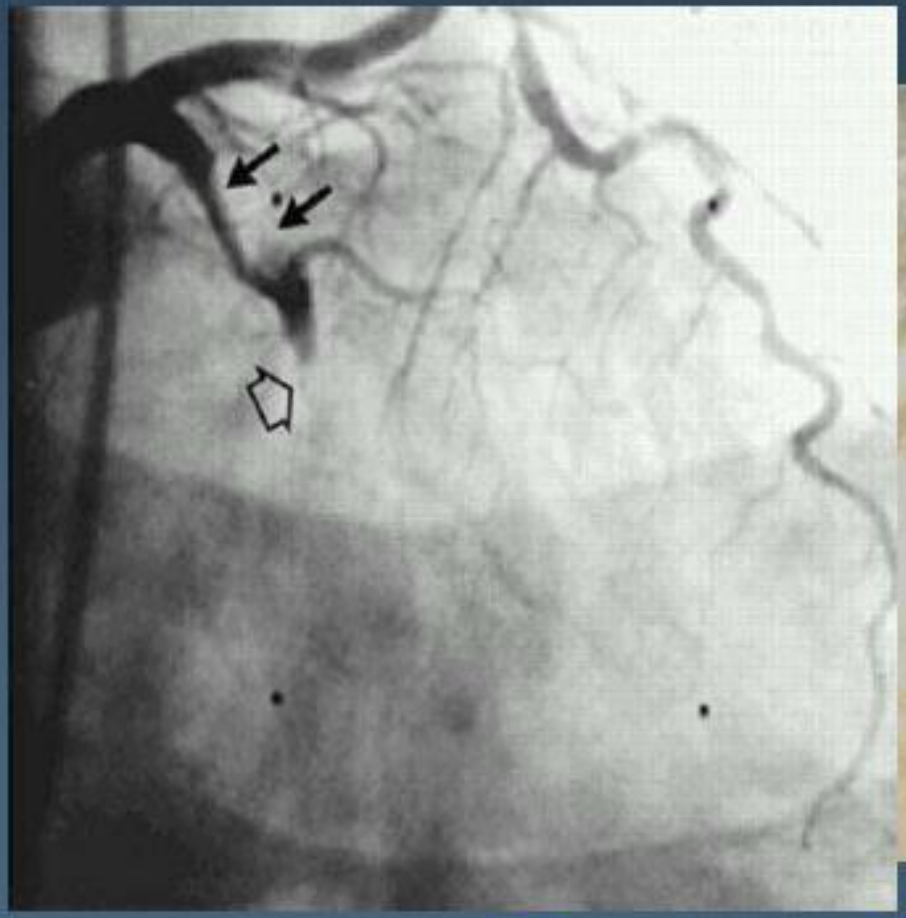
ACS without Persistent St-segment Elevation

Adapted from Michael Davies



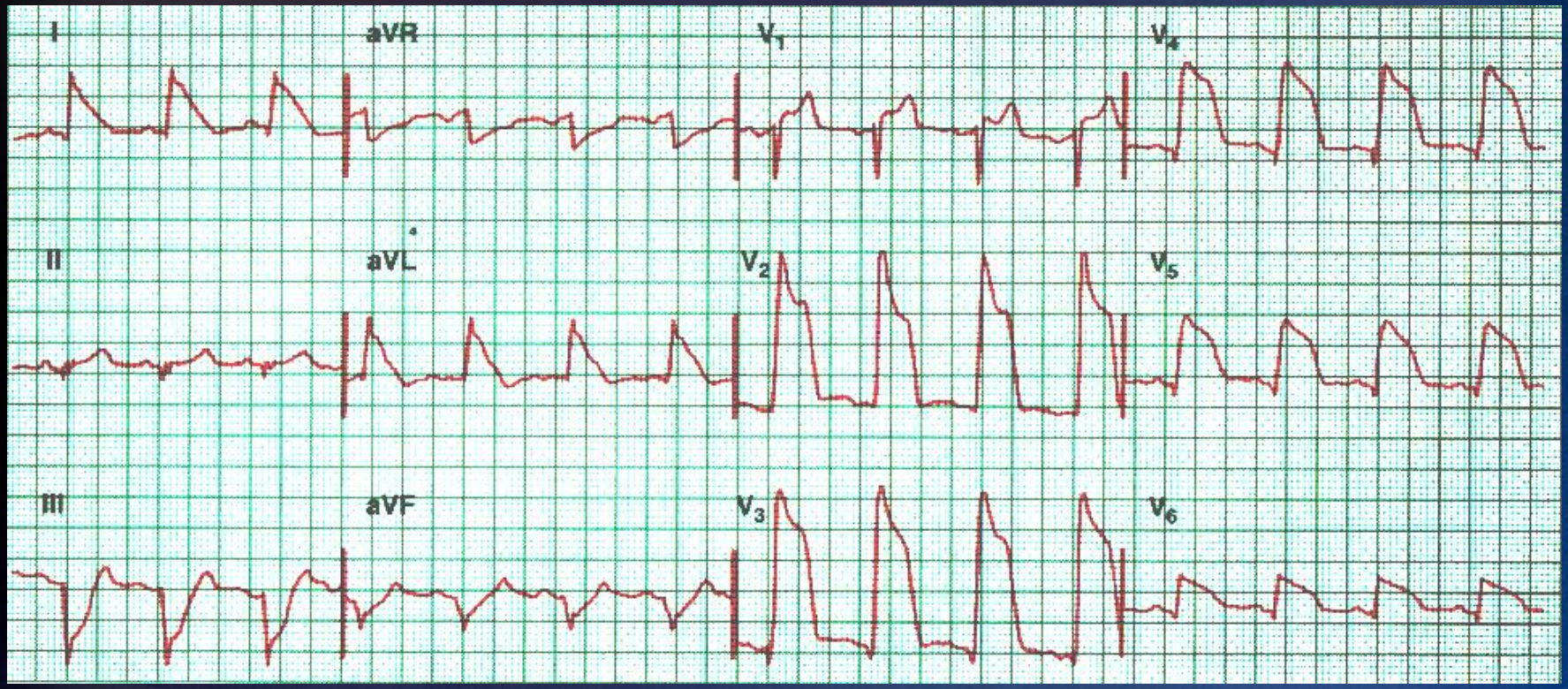
Troponin elevated or not

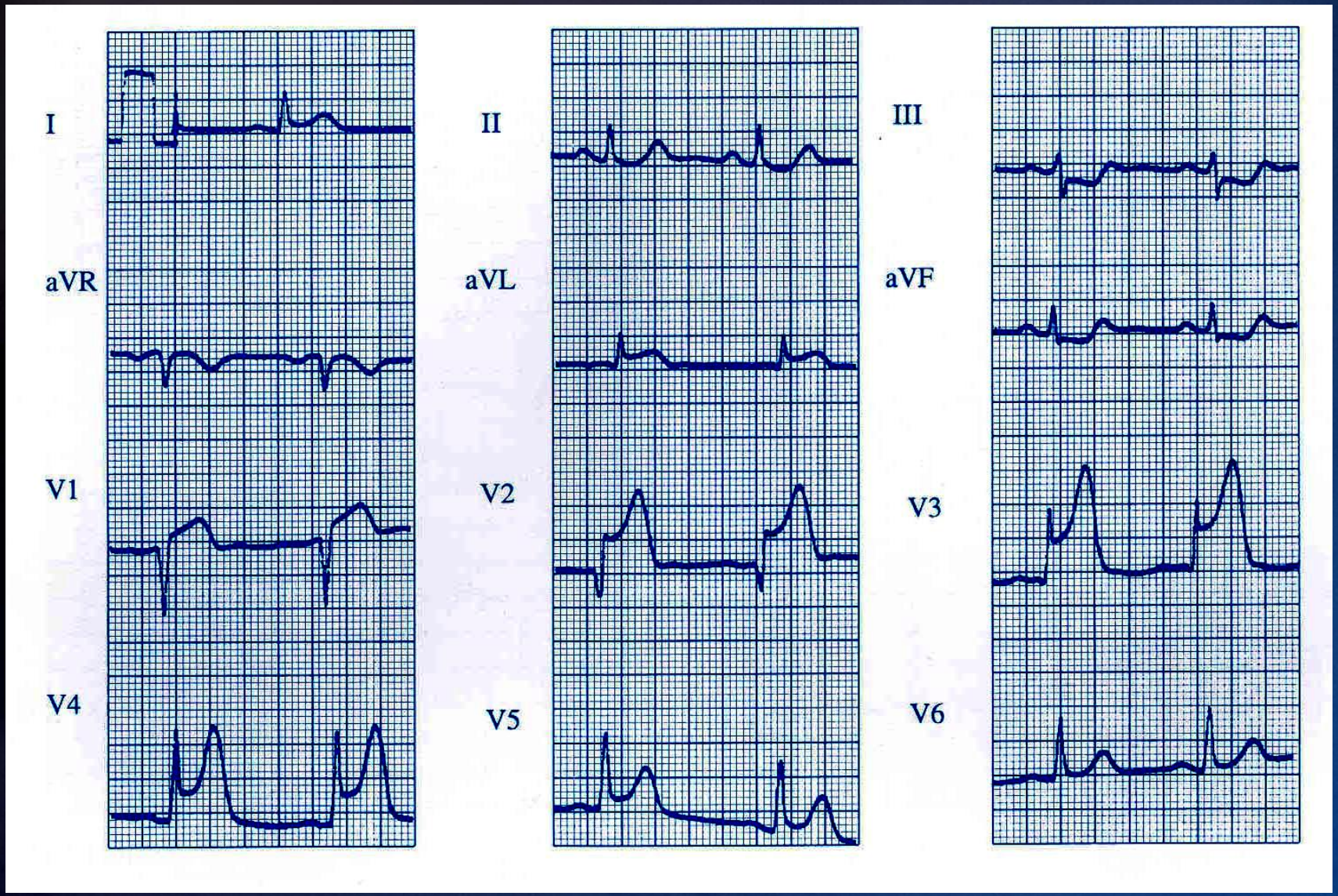
AMI: Pathophysiology



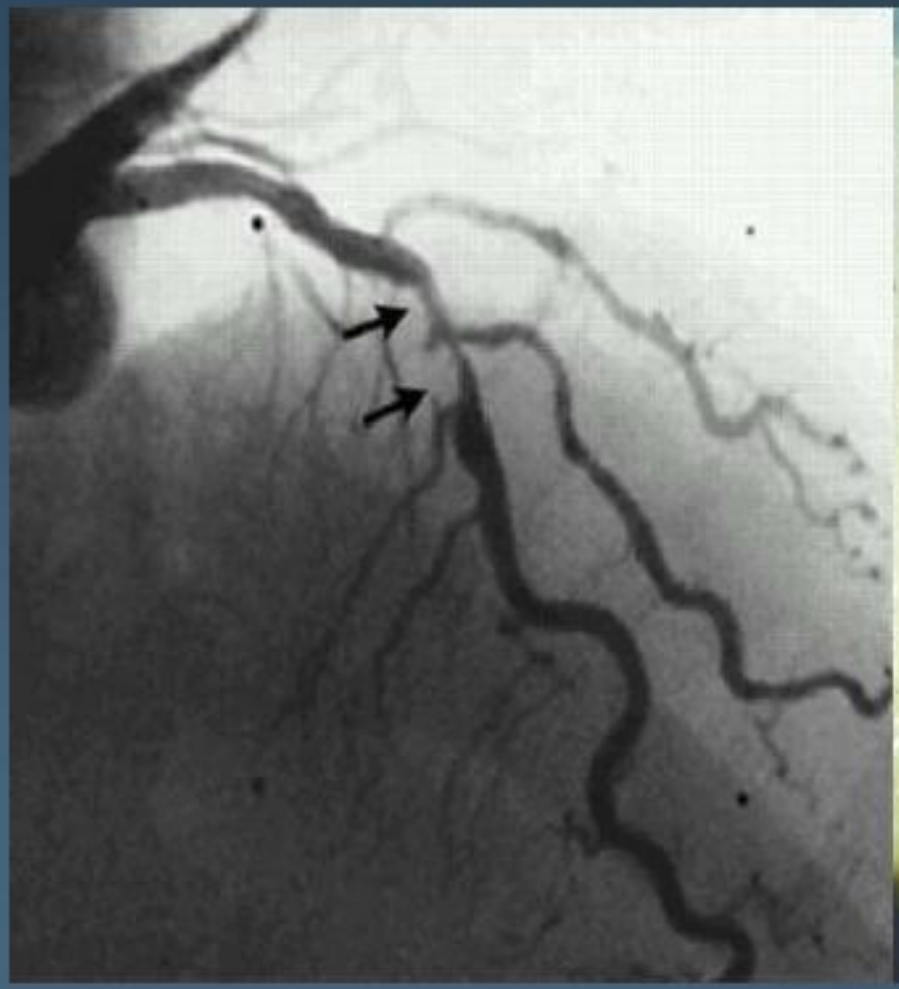
Ruptured plaque with occlusive thrombus

Hyperacute phase of extensive anterior-lateral myocardial infarction

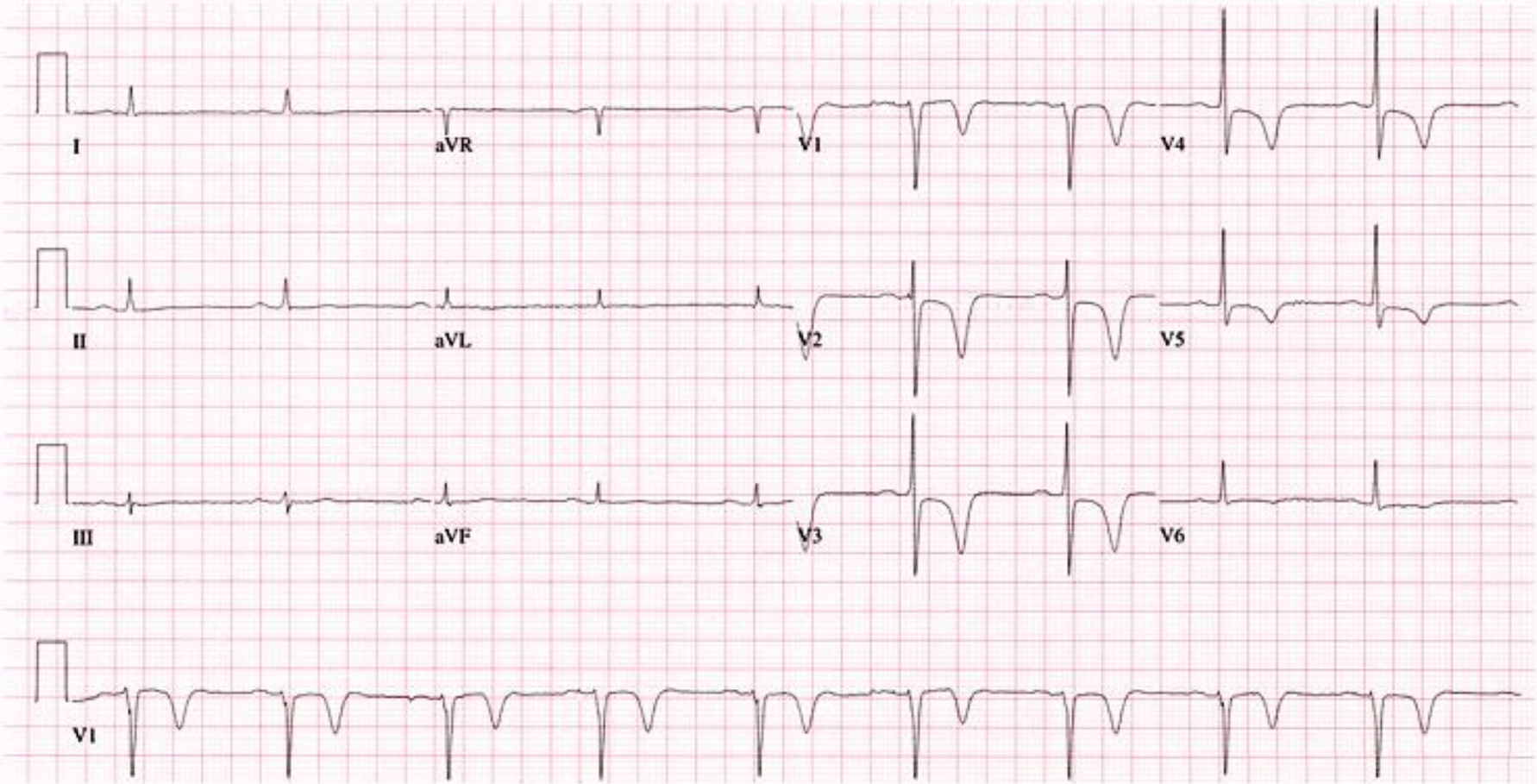



I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

ACS: Pathophysiology



Ruptured plaque with subocclusive thrombus


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1

Management of ACS

ACS Treatment: Objectives

Prevent MI and death

↓

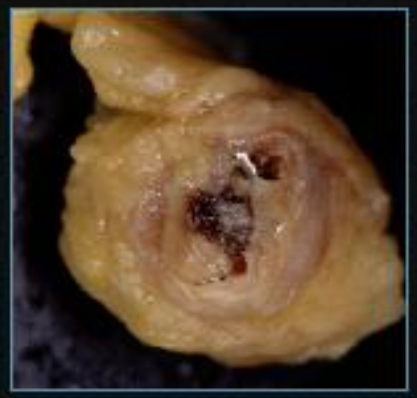
Improve quantity of life

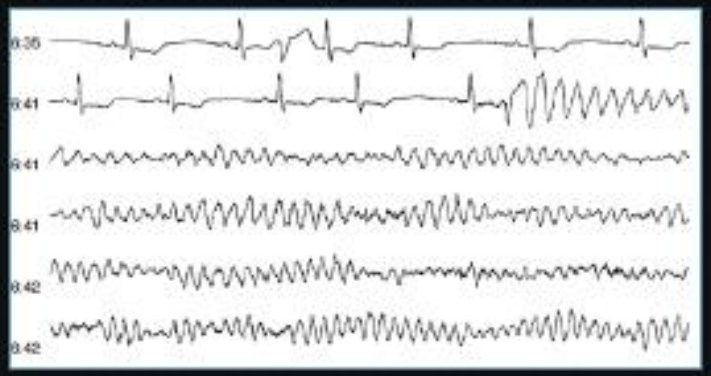
Reduce ischemia and relieve anginal symptoms

↓

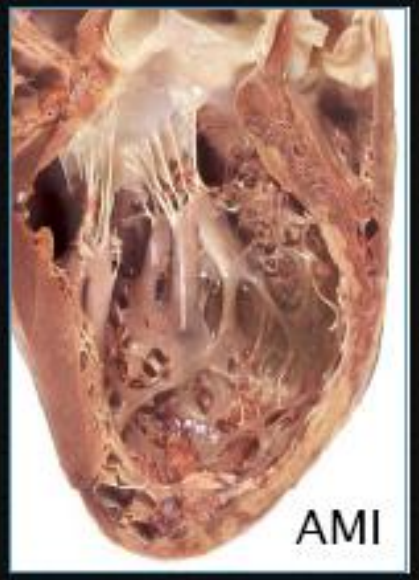
Improve quality of life

HEART ATTACT !!!!

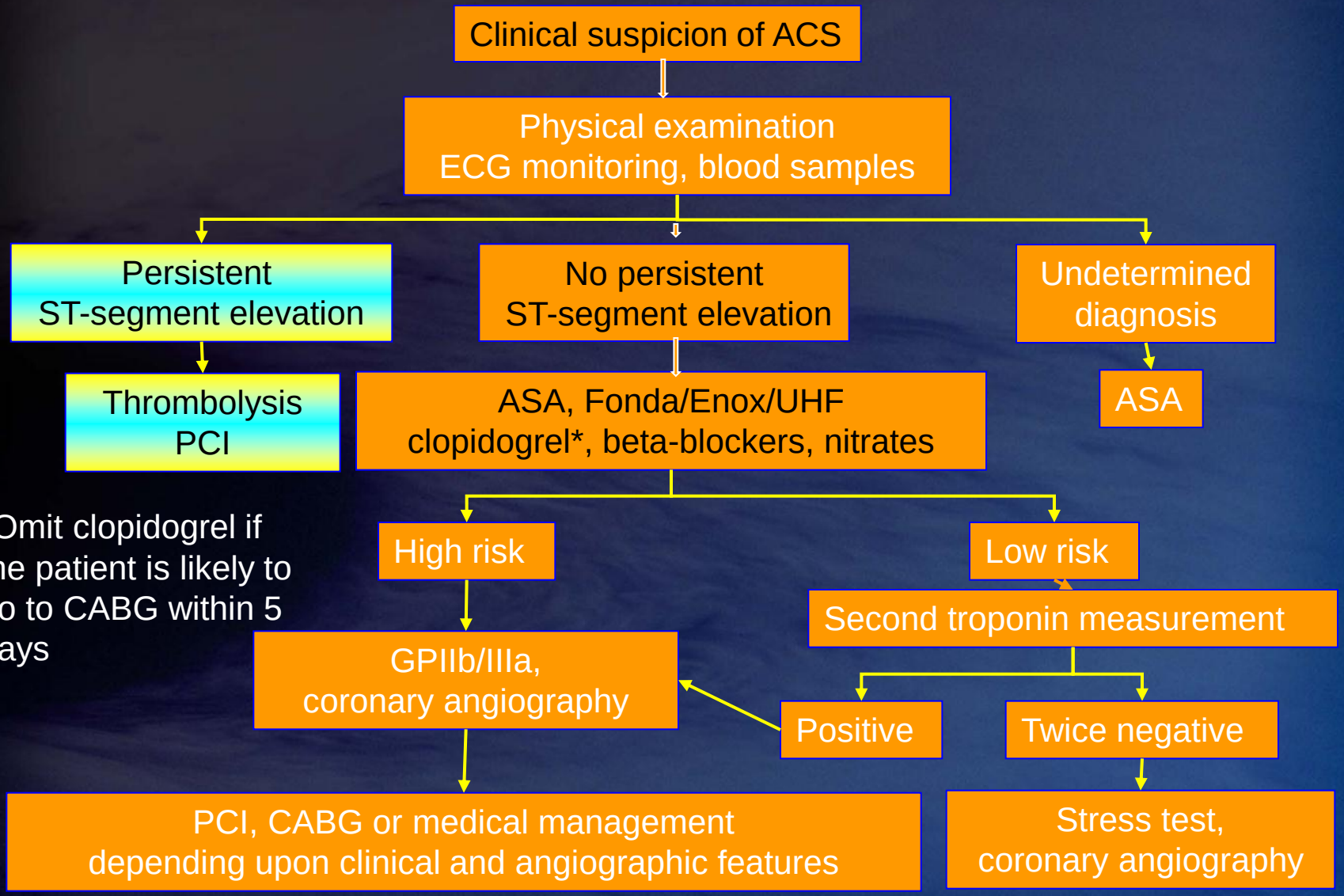




Arrhythmia



ESC : Management Strategy in ACS Patients



1. Bertrand ME et al. *Eur Heart J* 2002; 23; 1809–1840.

Management of STEMI

Key Messages remain unchanged:

- Early diagnosis
- Reperfusion therapy as soon as possible
- Optimal secondary prevention

Goals of Treatment

Reduce Infarct size

Reduce Mortality

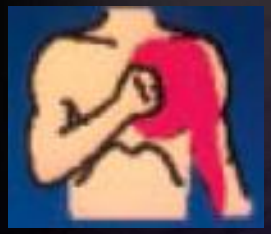
Prevention of Unfavorable Clinical Events

- Recurrent Myocardial infarction
- Congestive heart failure
- Sudden death
- Arrhythmias
- Repeat Intervention

Avoid complication

Safety

Satler L. SCAI-ACC I2 Summit 2008

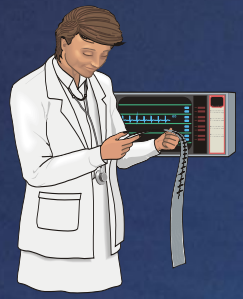


Symptom Recognition

Call to Medical System

Prehospital

ED

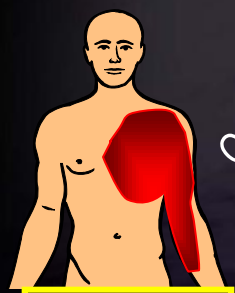


CCU

Cath Lab

Delay in initiation of Pharmacologic Reperfusion

PELAYANAN KEGAWATAN JANTUNG KORONER



Call 9-1-1
Call fast

Onset of symptoms of STEMI

9-1-1 EMS Dispatch

EMS on-scene
- Encourage 12-lead ECGs
- Consider prehospital fibrinolytic if capable and EMS-to-needle within 30 min

EMS Triage Plan

Hospital fibrinolysis :
Door-to-Needle within 30 min

Not PCI capable

Inter-Hospital Transfer

PCI capable

Goals†

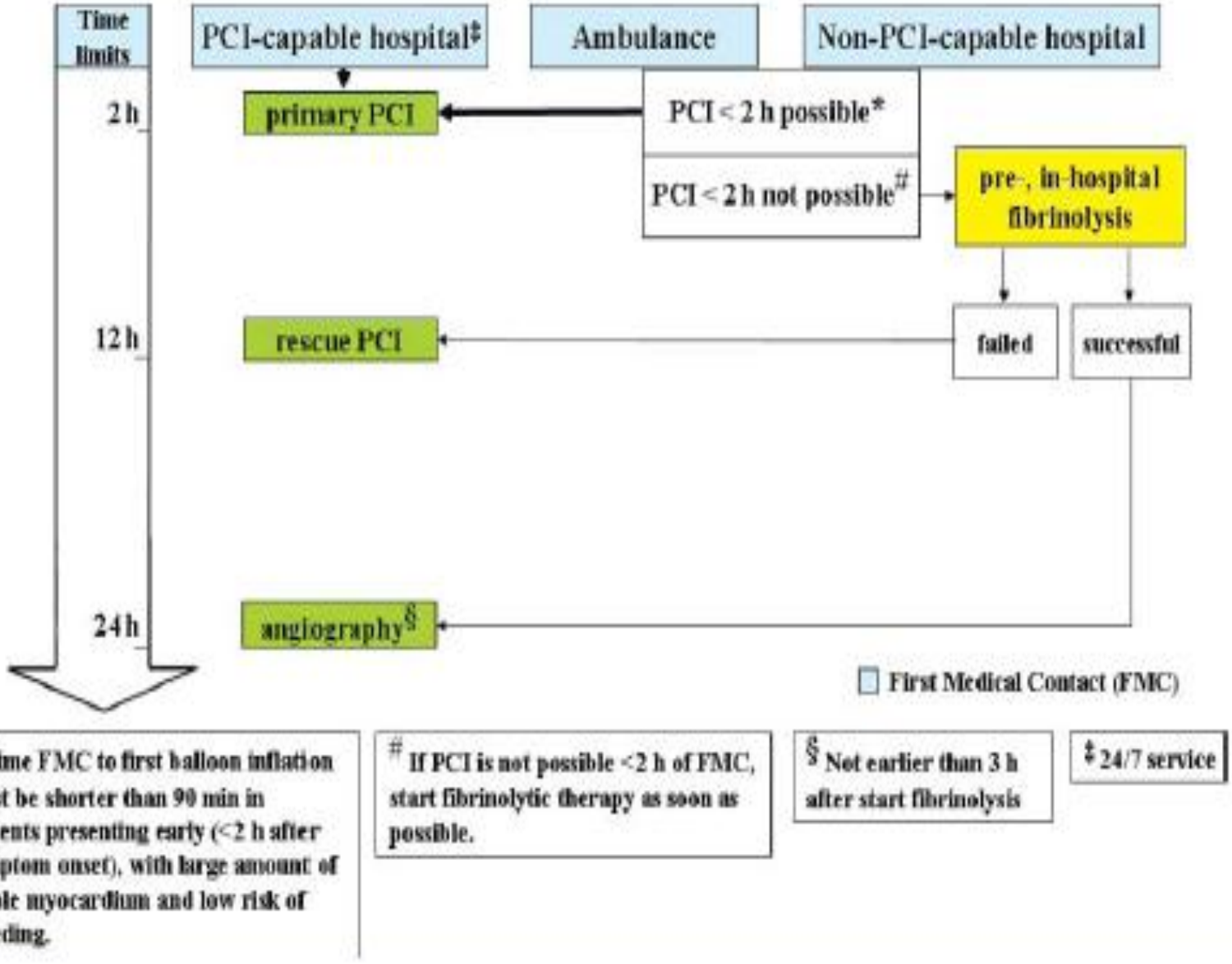
Patient	*Dispatch*	EMS on scene	***EMS transport***
5 min after symptom onset	1 min	Within 8 min	Prehospital fibrinolysis : EMS-to-Handle within 30 min

EMS transport:EMS-to-Balloon within 90 min

Patient self-transport:Hospital Door-to-Balloon within 90 min

Total ischemic time: Within 120 min*

***Golden Hour = First 60 minutes**


Time limits
PCI-capable hospital‡
Ambulance
Non-PCI-capable hospital
2 h
primary PCI
PCI < 2 h possible*
PCI < 2 h not possible#
pre-, in-hospital fibrinolysis
12 h
rescue PCI
failed
successful
24 h
angiography§
First Medical Contact (FMC)
* Time FMC to first balloon inflation must be shorter than 90 min in patients presenting early (<2 h after symptom onset), with large amount of viable myocardium and low risk of bleeding.
# If PCI is not possible <2 h of FMC, start fibrinolytic therapy as soon as possible.
§ Not earlier than 3 h after start fibrinolysis
‡ 24/7 service

REPERFUSION

CLASS I

1. **STEMI patients presenting to a hospital with PCI capability should be treated with primary PCI within 90 minutes of first medical contact as a system goal (Level of Evidence : A)**

2. **STEMI patients presenting to a hospital without PCI capability and who cannot be transferred to a PCI center and undergo PCI within 90 minutes of first medical contact, should be treated with fibrinolytic therapy within 30 minutes of hospital presentation as a system goal unless fibrinolytic therapy is contraindicated (Level of Evidence : B)**

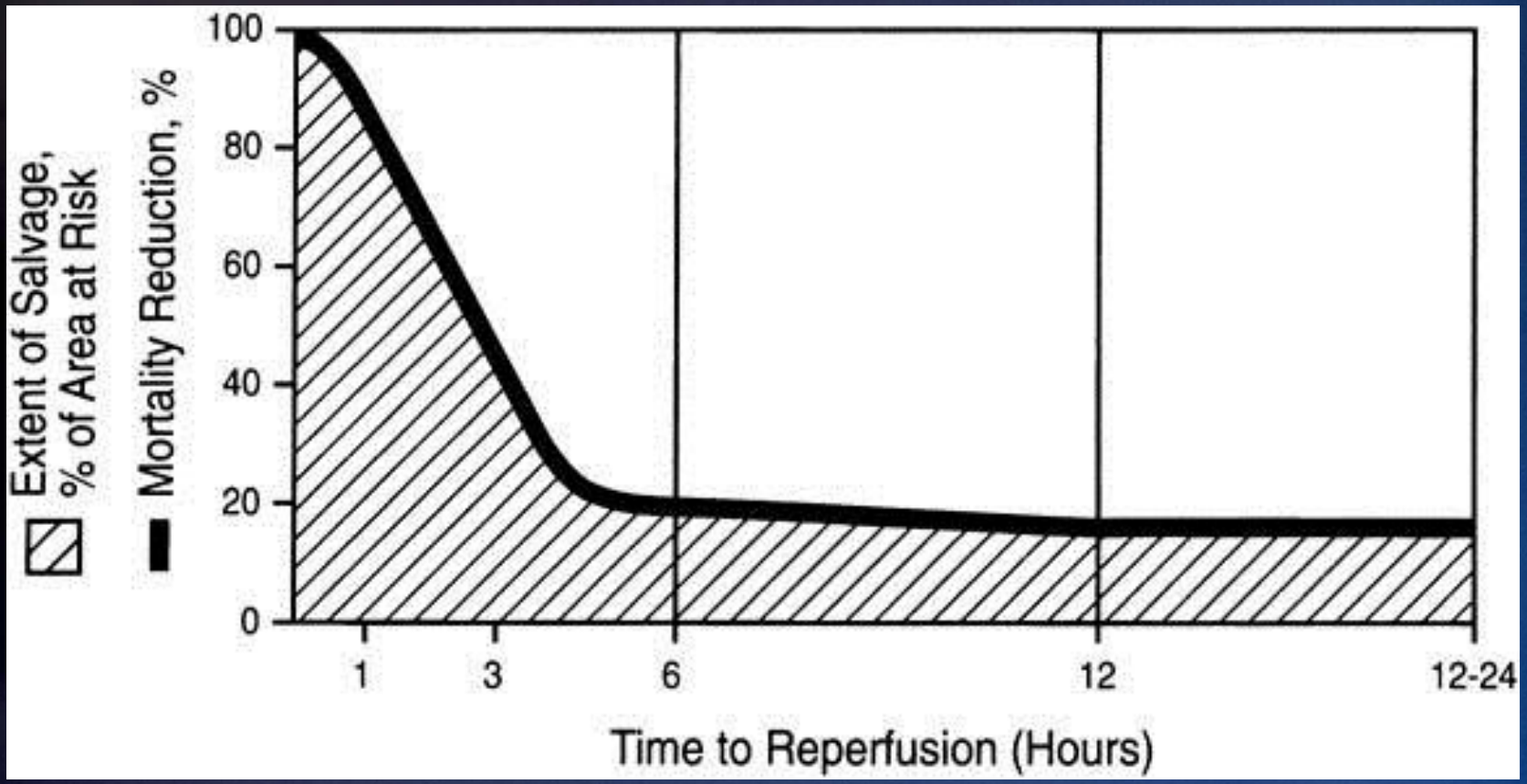
European Heart Journal (2007) 28,882

Time to presentation…

- **Survival benefit greatest when lytics administered within first 3 hours after onset of symptoms, particularly within the first 70 minutes**
- **Mortality benefit less likely at 13-18 hours**
- **There MAY be benefit in patients presenting >12hours if patient has on-going chest pain**

"AHA recommendations (2004): administer lytics if no contraindications w/in 12 hr of symptom onset; reasonable to administer at 12-24 hr if continuing symptoms or persistent ST elevation on EKG"

Time & Myocardial Salvage



Long-term survival…

- Long-term benefit primarily seen in patients who achieved **TIMI 3 flow** w/ lytic administration
- Vessel opening (TIMI 2 or 3) reported in **60-87% of patients** receiving lytics, but normalization (TIMI 3) in **only 50-60%** of arteries. **Only TIMI 3 flow associated w/ improved LV function and survival**
- Note: TIMI 3 flow is achieved in **~90% of patients treated with primary PCI !!!**

CONTRAINDICATIONS

It is estimated that 20-30% of patients ineligible for thrombolytic therapy…

This is what we missed on the in-service!!

Contraindications to Fibrinolytic Therapy (1)

- **Absolute contraindications**
  - Haemorrhagic stroke or stroke of unknown origin at any time
  - Ischaemic stroke in preceding 6 months
  - Central nervous system trauma or neoplasms
  - Recent major trauma/surgery/head injury (within preceding 3 weeks)
  - Gastro-intestinal bleeding within the last month
  - Known bleeding disorder
  - Aortic dissection
  - Non-compressible punctures (e.g. liver biopsy, lumbar puncture)

Contraindications to Fibrinolytic Therapy (2)

- **Relative contraindications**
  - Transient ischaemic attack in preceding 6 months
  - Oral anticoagulant therapy
  - Pregnancy or within 1 week post partum
  - Refractory hypertension (SBP > 180 mmHg and/or DBP > 110 mmHg)
  - Advanced liver disease
  - Infective endocarditis
  - Active peptic ulcer
  - Refractory resuscitation

What agents...

- Some agents : Streptokinase, alteplase, reteplase, and tenecteplase
- Identical in effectiveness, safety, yield the same success rate
- Performed dual iv-line
- Streptokinase dose : 1.5 million iu, given over 40-60 mnt
- Pretreatment :
  - Ranitidine & Ondansetron - IV
  - Diphenhydramine (Benadryl), 25 mg - IV

Therapeutic Standard

- **Oxygen**, should be guided by pulse oximetry
- **Nitroglycerin** (SL tab or spray, paste, or IV), unless there is hypotension or allergy or susp RV infarction
- **Morphine sulphate** if nitroglycerin does not relieve chest pain, unless C.I. by hypotension or allergy.
- **Aspirin** given immediately : 162 – 325 mg orally, **non-enteric coated !!**
- **Clopidogrel** : 300 mg orally, followed by 75 mg daily
- **Lidocaine or other anti-dysrrhythmic agent** if the px manifests significant new arrhythmia (>> 6 PVCs/min, multifocal PVCs, 3-beat V-tach, etc).
- **Start Fibrinolytic therapy in the emergency room**, If not the **reason should be stated in the chart !**

Recommendations for Oral Antiplatelet Drugs (1)

- Aspirin is recommended for all patients presenting with NSTE-ACS without contraindication at an initial loading dose of 160 - 325mg (non-enteric) (I-A), and at a maintenance dose of 75 to 100mg long-term (I-A).
- For all patients, immediate 300mg loading dose of clopidogrel is recommended, followed by 75mg clopidogrel daily (I-A). Clopidogrel should be maintained for 12 months unless there is an excessive risk of bleeding (I-A).
- For all patients with contraindication to aspirin, clopidogrel should be given instead (I-B).

ESC Guidelines for the Management of NSTE-ACS (61)

Management of NSTEMI / UA

Primary therapeutic measures

Oxygen	Insufflation (4 to 8 L/min) if oxygen saturation is < 90%
Nitrates	Sublingually or intravenously (caution if systolic blood pressure < 90mmHg)
Aspirin	Initial dose of 160–325mg non-enteric formulation followed by 75–100 mg/d (intravenous administration is acceptable)
Clopidogrel	Loading dose of 300mg (or 600mg for rapid onset of action) followed by 75 mg daily
Anticoagulation	Choice between different options depends on strategy: • UFH intravenous Bolus 60–70 IU/kg (maximum 5000 IU) followed by infusion of 12–15 IU/kg/h (IU/h maximum 1000) titrated to aPTT 1.5–2.5 times control • Fondaparinux 2.5 mg/daily subcutaneously • Enoxaparin 1 mg/kg twice/daily subcutaneously • Dalteparin 120 IU/kg twice/daily subcutaneously • Nadroparin 86 IU/kg twice/daily subcutaneously • Bivalirudin 0.1 mg/kg bolus followed by 0.25 mg/kg/h
Morphine	3 to 5 mg intravenous or subcutaneous, depending on pain severity
Oral betablocker	Particularly, if tachycardia or hypertension without sign of heart failure
Atropine	0.5 - 1 mg intravenously, if bradycardia or vagal reaction

ESC Guidelines for the Management of NSTE-ACS (129)

Therapeutic Options

- Anti-ischaemic agents
- Anti-coagulants
  - UFH or LMWHs
  - Fondaparinux
  - Bivalirudin
- Anti-platelet agents
  - ASA
  - Clopidogrel
  - IIbIIIa Inhibitors
- Revascularisation

Risk Stratification

1. **Features of high risk that mandates urgent angiography / revascularization**
   - Refractory angina (e.g. evolving MI without ST abnormalties)
   - Recurrent angina despite intense antianginal treatment associated with ST depression (≥ 2 mm) or deep negative T waves.
   - Clinical symptoms of heart failure or haemodynamic instability (" shock")
   - Life threatening arrhythmias (ventricular fibrillation or ventricular tachycardia)

ESC Guidelines for the Management of NSTE-ACS (125)

Risk Stratification

2 - Features of high risk that mandates early (<72 hours) angiography / revascularization

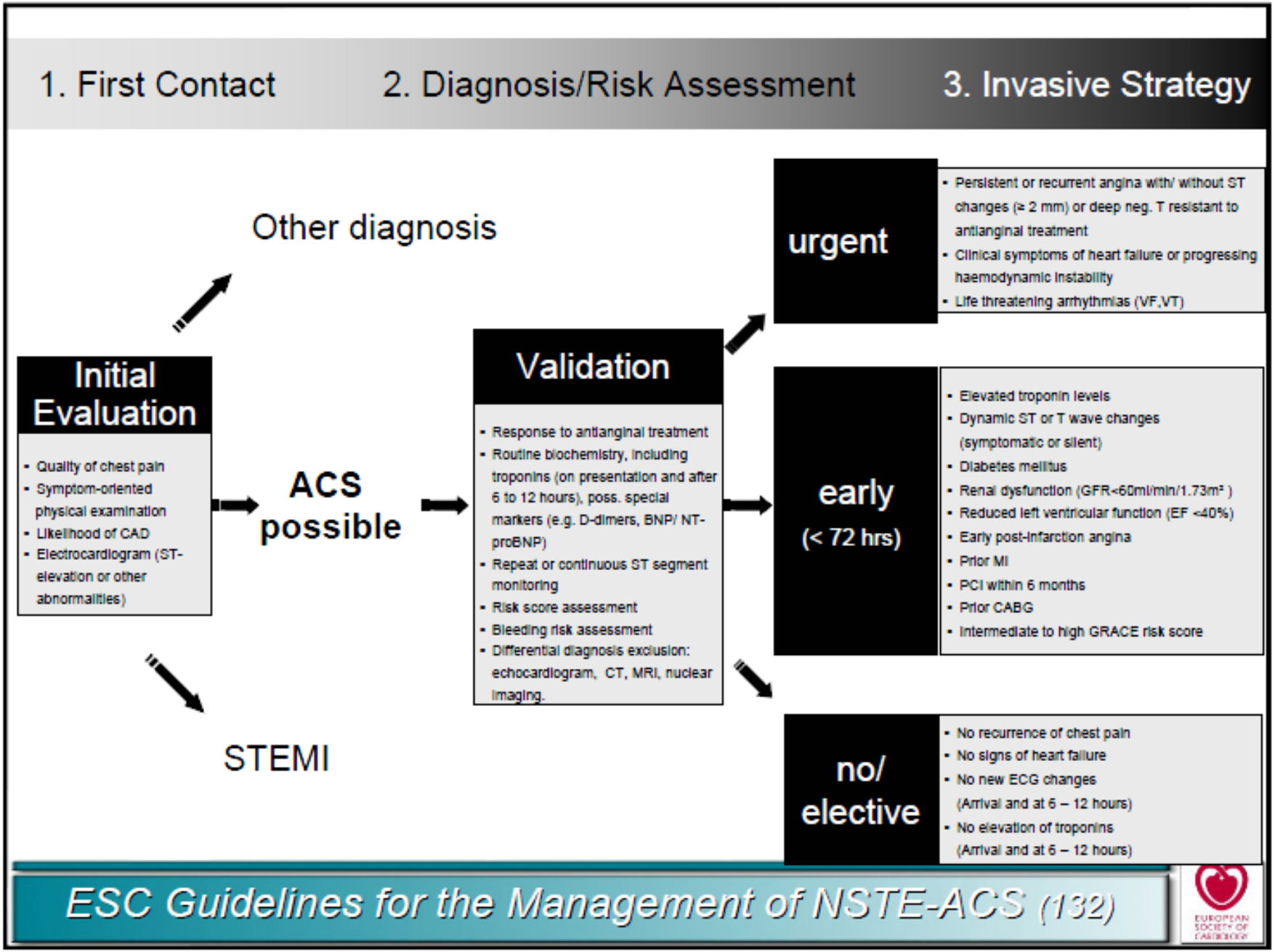
- Elevated troponin levels
- Dynamic ST or T wave changes (symptomatic or silent) (≥ 0.5mm)
- Diabetes mellitus
- Reduced renal function (GFR < 60 ml/min/1.73m^2)
- Depressed LVEF < 40%
- Early post MI angina
- PCI within 6 months
- Prior CABG
- Intermediate to high risk according to a risk score

ESC Guidelines for the Management of NSTE-ACS (126)

Risk Stratification

3 - No features of high risk

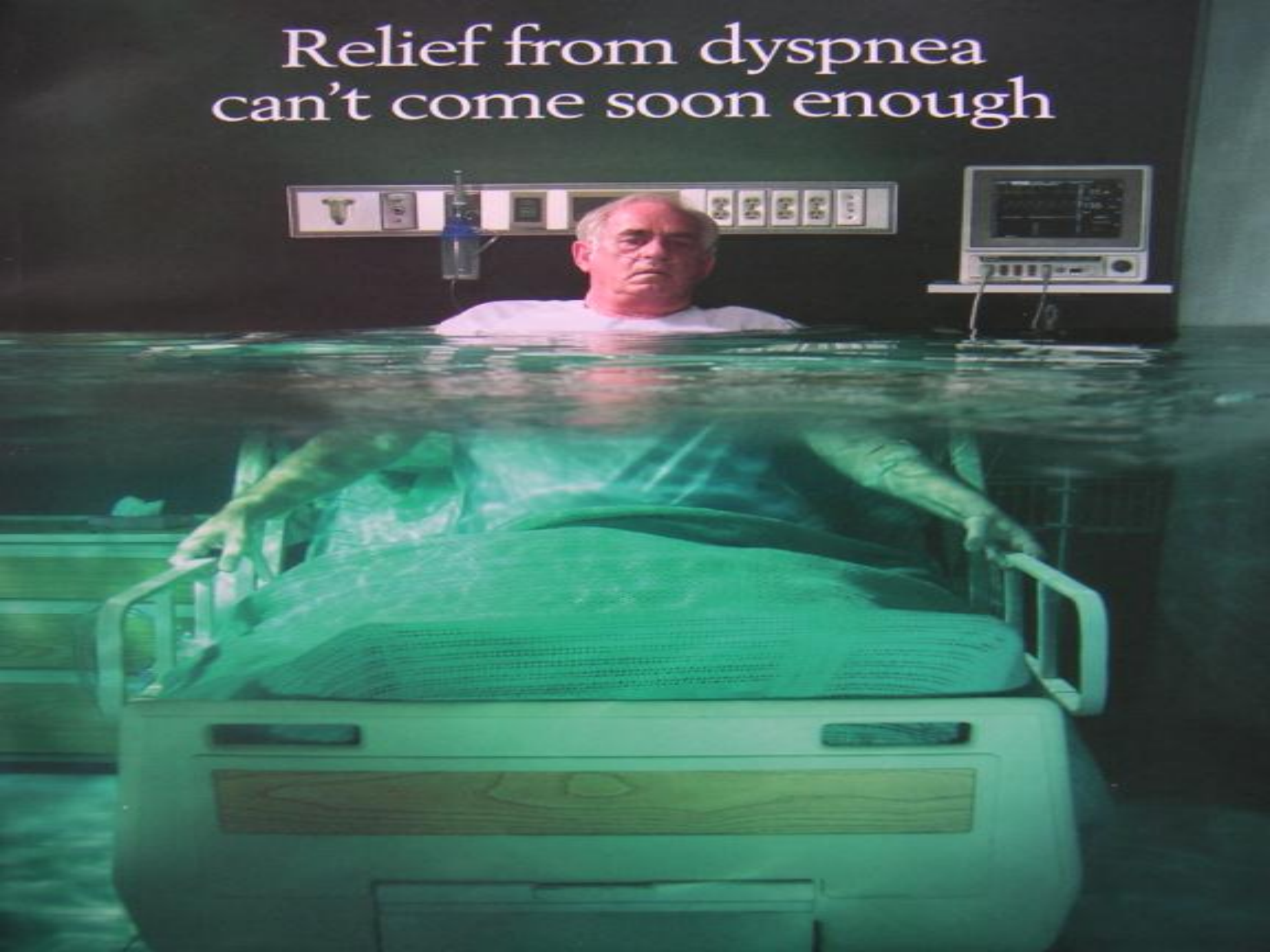
- No recurrence of chest pain
- No signs of heart failure
- No abnormalities in the initial ECG or a second ECG (6 to 12 hours)
- No elevation of troponins (arrival and at 6 – 12 hours)


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
STEMI
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)
• Repeat or continuous ST segment monitoring
• Risk score assessment
• Bleeding risk assessment
• Differential diagnosis exclusion: echocardiogram, CT, MRI, nuclear imaging.
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)
early
(< 72 hrs)
• Elevated troponin levels
• Dynamic ST or T wave changes (symptomatic or silent)
• Diabetes mellitus
• Renal dysfunction (GFR<60ml/min/1.73m²)
• Reduced left ventricular function (EF <40%)
• Early post-infarction angina
• 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 (Arrival and at 6 – 12 hours)
ESC Guidelines for the Management of NSTE-ACS (132)
EUROPEAN SOCIETY OF CARDIOLOGY

Recommendations for Anticoagulation (2)

- In an non-urgent situation, as long as decision between early invasive or conservative strategy is pending :
  - Fondaparinux is recommended on the basis of the most favorable efficacy/safety profile. (I-A)
  - Enoxaparin with a less favourable efficacy/safety profile than fondaparinux should be used only if the bleeding risk is low (IIa-B)
  - As efficacy/safety profile of LMWH (other than enoxaparin) or UFH relative to fondaparinux is unknown; these anticoagulants cannot be recommended over fondaparinux (IIa-B)

ESC Guidelines for the Management of NSTE-ACS (54)


Relief from dyspnea
can't come soon enough

1990s: How to Reperfuse Faster

Pre-hospital Thrombolysis