Acute Coronary Syndromes

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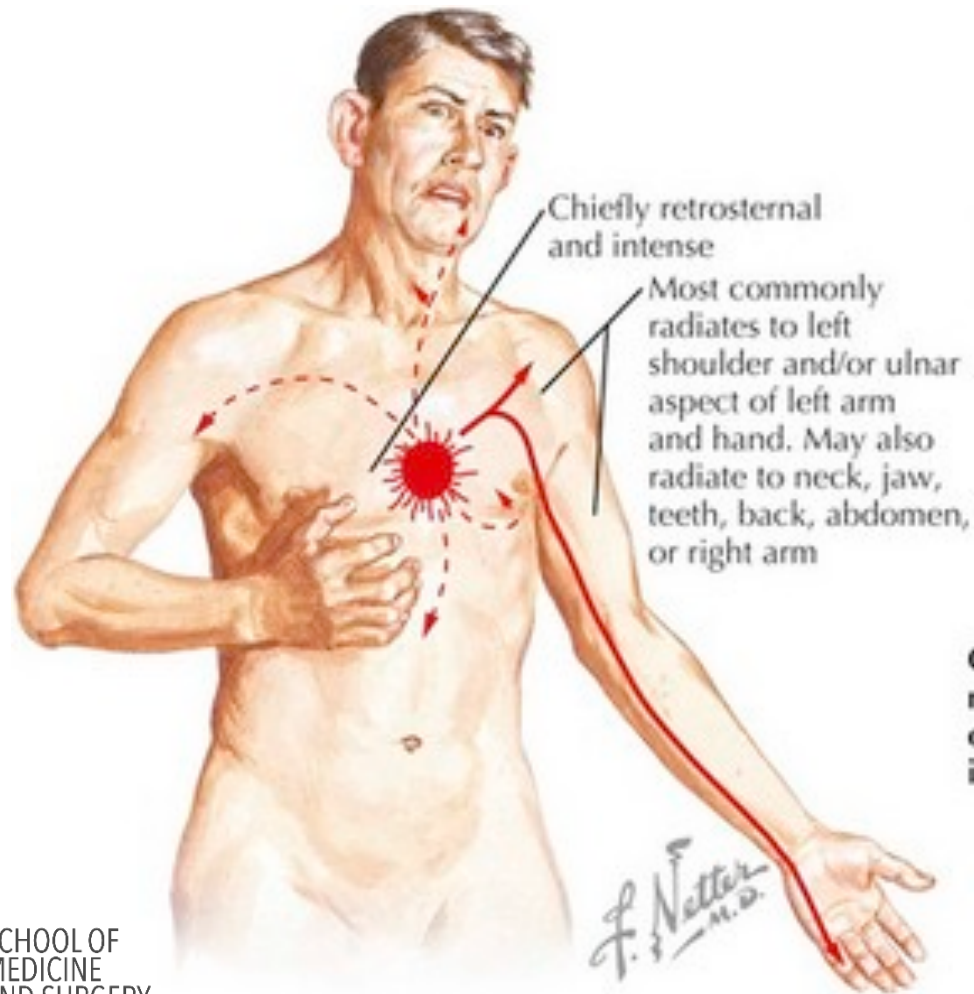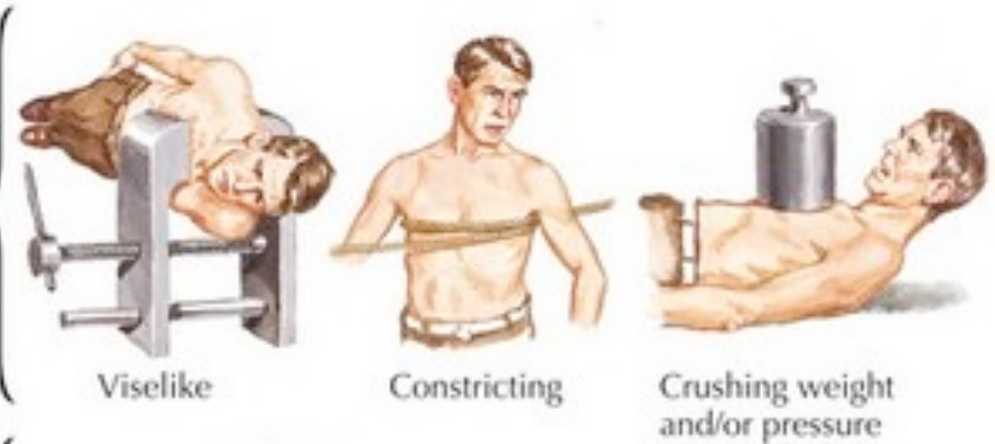
Acute Coronary Syndromes

Definition

Acute coronary syndrome (ACS) is a unifying term representing a pathophysiologic and clinical spectrum culminating in acute myocardial ischemia. ACS encompasses unstable angina, ST-segment elevation myocardial infarction (STEMI), and non-ST-segment myocardial infarction (NSTEMI)
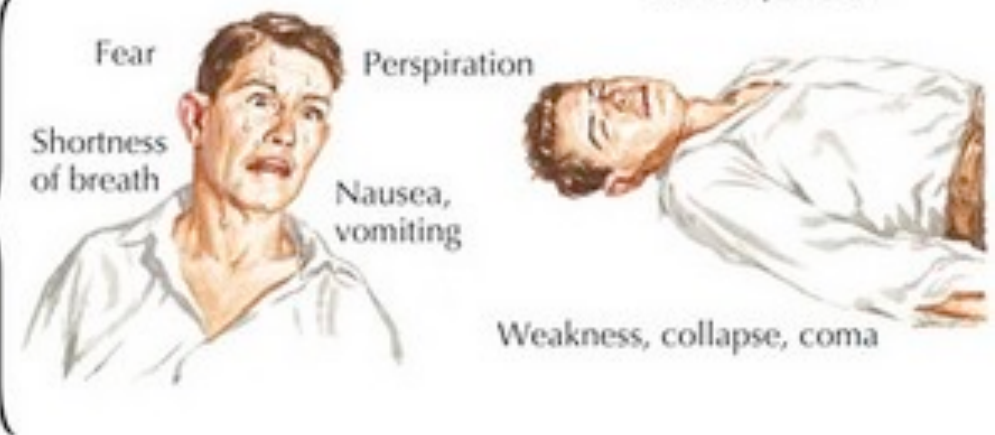
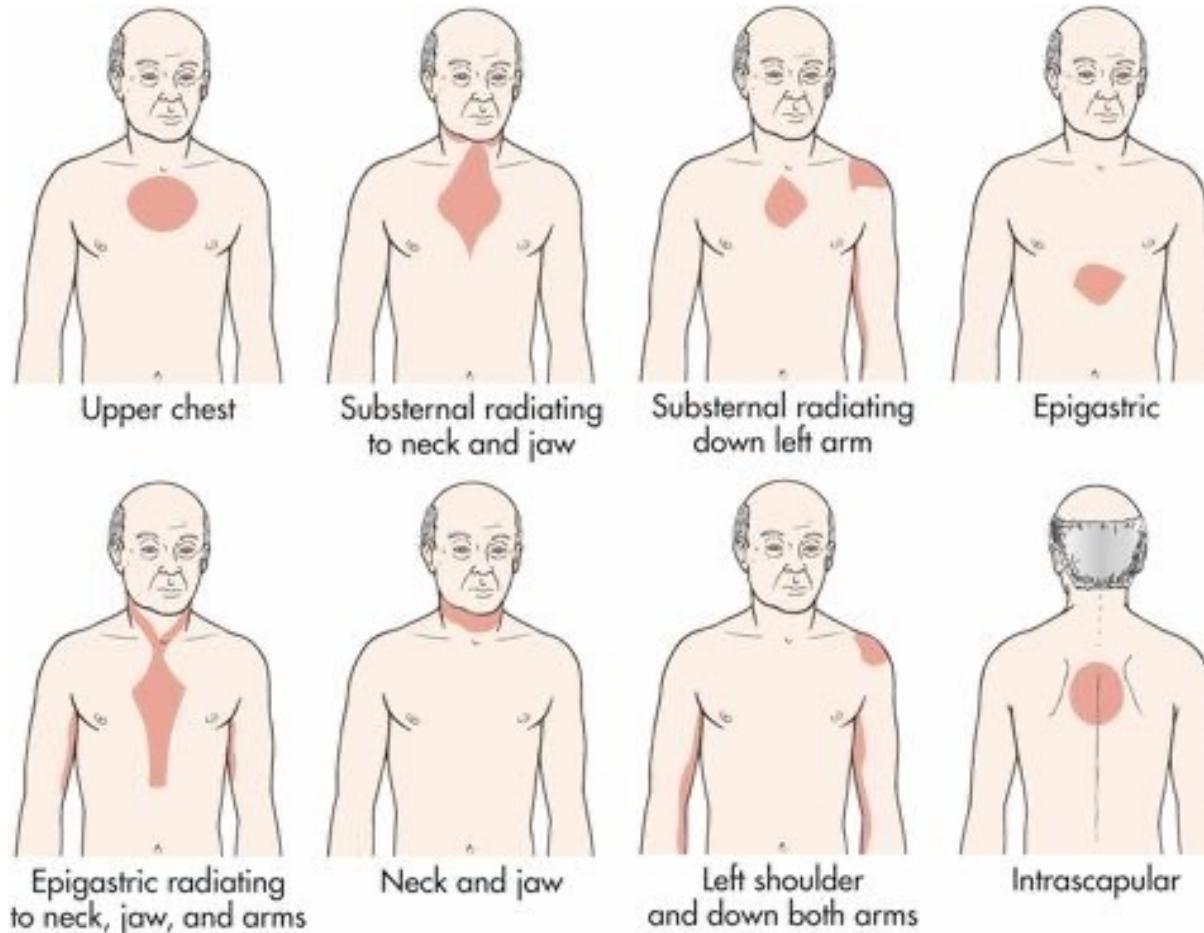# Acute Coronary Syndromes

Clinical presentation

Acute Coronary Syndromes

Clinical presentation

Chest pain is less in women, their common symptoms are weakness, fatigue & dyspnea

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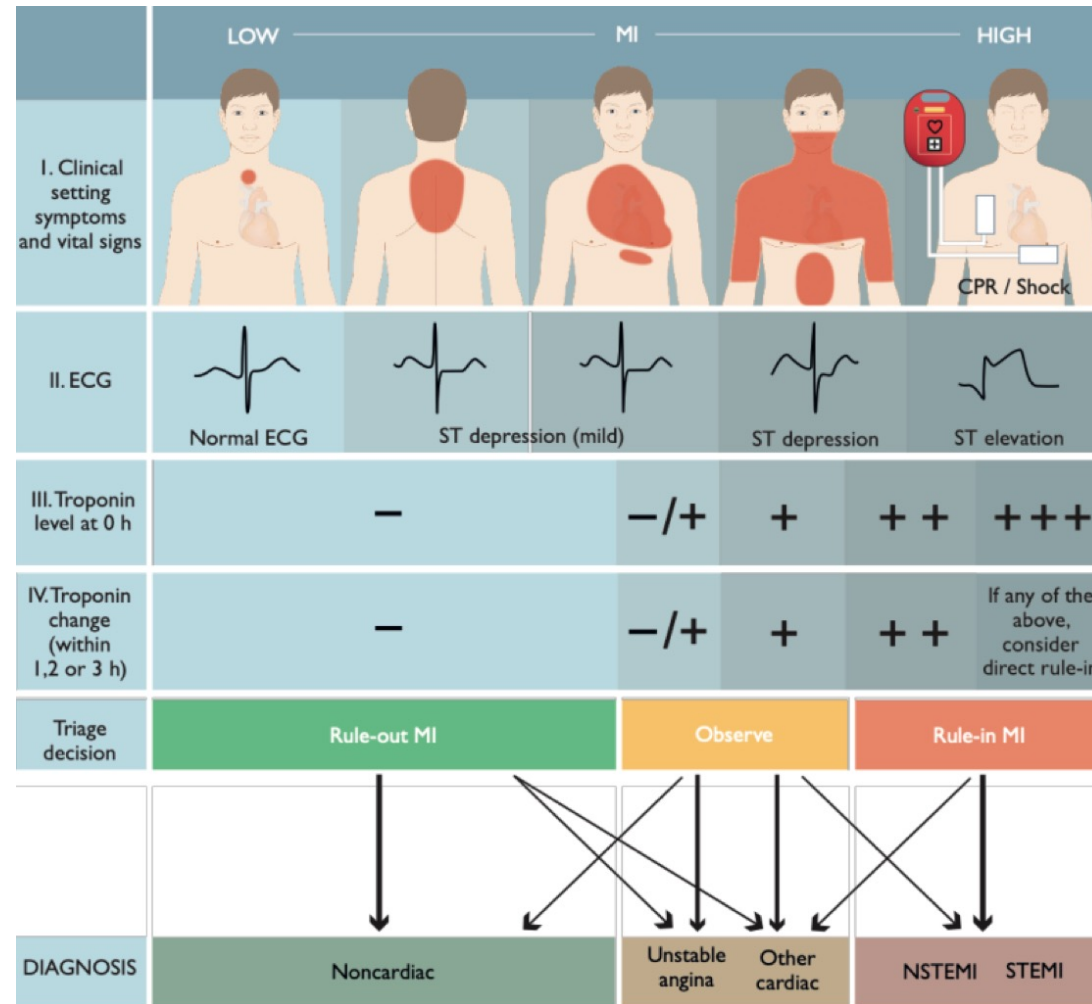
Differential diagnosis of chest pain

Cardiac	Pulmonary	Vascular	Gastro-intestinal	Orthopaedic	Other
Myopericarditis	**Pulmonary embolism**	**Aortic dissection**	**Oesophagitis, reflux, or spasm**	**Musculoskeletal disorders**	**Anxiety disorders**
Cardiomyopathies[a]	**(Tension)-pneumothorax**	Symptomatic aortic aneurysm	Peptic ulcer, gastritis	Chest trauma	Herpes zoster
Tachyarrhythmias	Bronchitis, pneumonia	Stroke	Pancreatitis	Muscle injury/inflammation	Anaemia
Acute heart failure	Pleuritis		Cholecystitis	Costochondritis	
Hypertensive emergencies				Cervical spine pathologies	
Aortic valve stenosis					
Takotsubo syndrome					
Coronary spasm					
Cardiac trauma					

Bold = common and/or important differential diagnoses.

[a]Dilated, hypertrophic and restrictive cardiomyopathies may cause angina or chest discomfort.

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Diagnostic algorithm and triage in ACS

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Value of high-sensitivity troponin

Collet JP et al. Eur Heart J 2020; doi: 10.1093/eurheartj/ehaa575
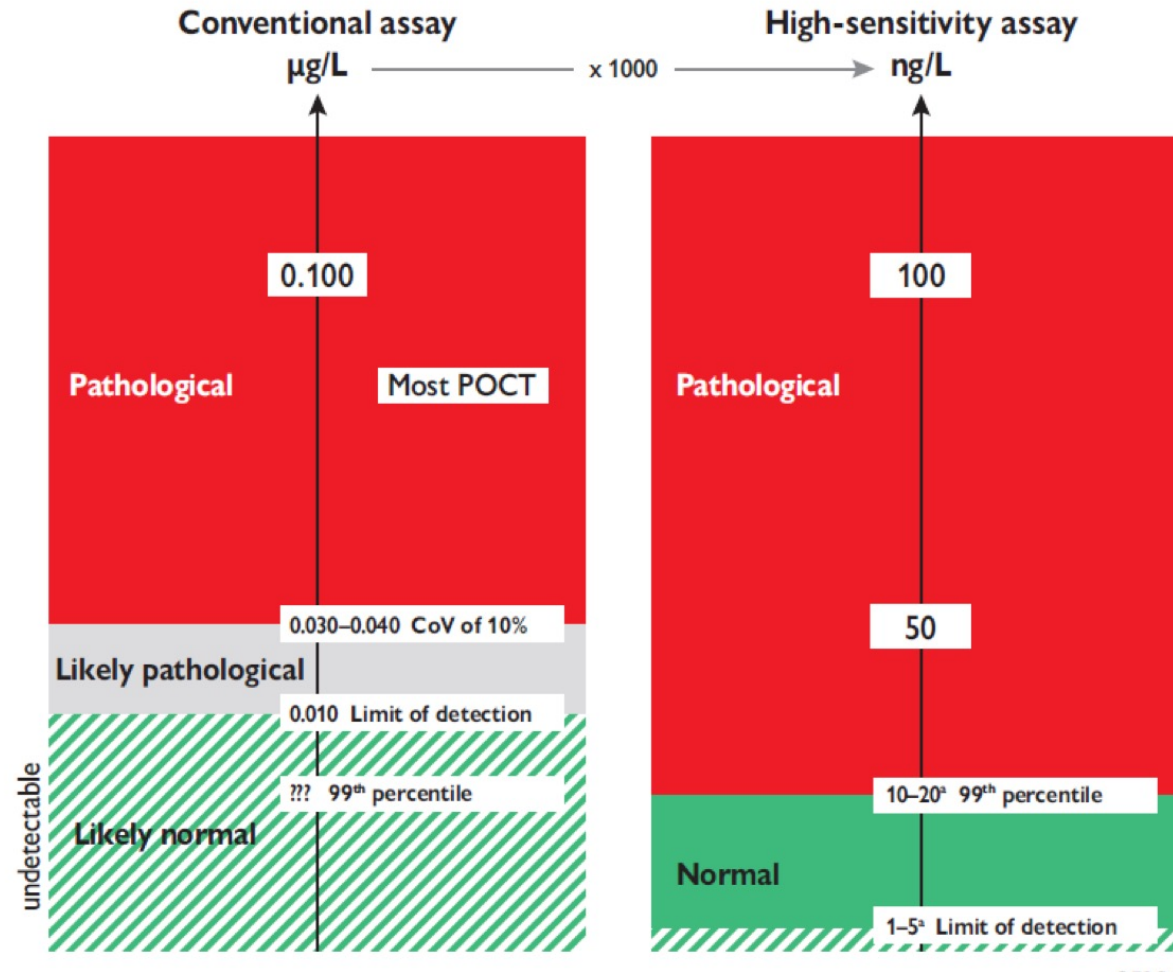
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Conditions other than type 1 MI associated with c-Tn elevation

Tachyarrhythmias
Heart failure
Hypertensive emergencies
Critical illness (e.g. shock/ sepsis/ burns)
Myocarditis[a]
Takotsubo syndrome
Valvular heart disease (e.g. aortic stenosis)
Aortic dissection
Pulmonary embolism, pulmonary hypertension
Renal dysfunction and associated cardiac disease

Bold = most frequent conditions. [a]Includes myocardial extension of endocarditis or pericarditis.

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Conditions other than type 1 MI associated with c-Tn elevation

Acute neurological event (e.g. stroke or subarachnoid haemorrhage)
Cardiac contusion or cardiac procedures (CABG, PCI, ablation, pacing, cardioversion, or endomyocardial biopsy)
Hypo- and hyperthyroidism
Infiltrative diseases (e.g. amyloidosis, haemochromatosis, sarcoidosis, scleroderma)
Myocardial drug toxicity or poisoning (e.g. doxorubicin, 5-fluorouracil, herceptin, snake venoms)
Extreme endurance efforts
Rhabdomyolysis

Bold = most frequent conditions. [a]Includes myocardial extension of endocarditis or pericarditis.

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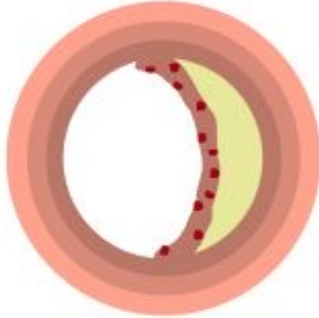
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Unstable angina

Unstable angina is usually secondary to abrupt reduction in myocardial perfusion as a result of a non-occlusive coronary thrombosis. However, the non-occlusive thrombus that developed on a disrupted atherosclerotic plaque does not result in biochemical evidence of myocardial necrosis

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Pathophysiology and clinical presentation of unstable angina

| PATHOPHYSIOLOGY		THROMBUS	CHEST PAIN SYMPTOMS
Ruptured plaque with non-occlusive thrombus* *Occlusive thrombus would typically cause a full STEMI.*		• White • Platelet-rich	• **Acute** chest pain • With activity **and** rest
Progressive mechanical obstruction		• Red • Fibrin-rich *Same pathophysiology as stable angina.*	• "Crescendoing angina" *Chest pain worsens over days to weeks.* • Should not occur at rest

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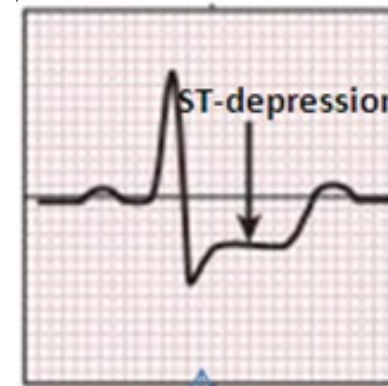
Electrocardiogram

Myocardial infarction

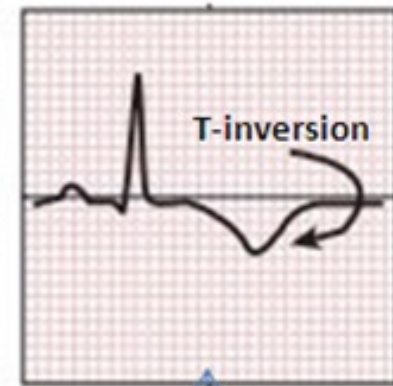**ST-segment elevation myocardial infarction (STEMI)**

Non ST-segment elevation myocardial infarction (NSTEMI)
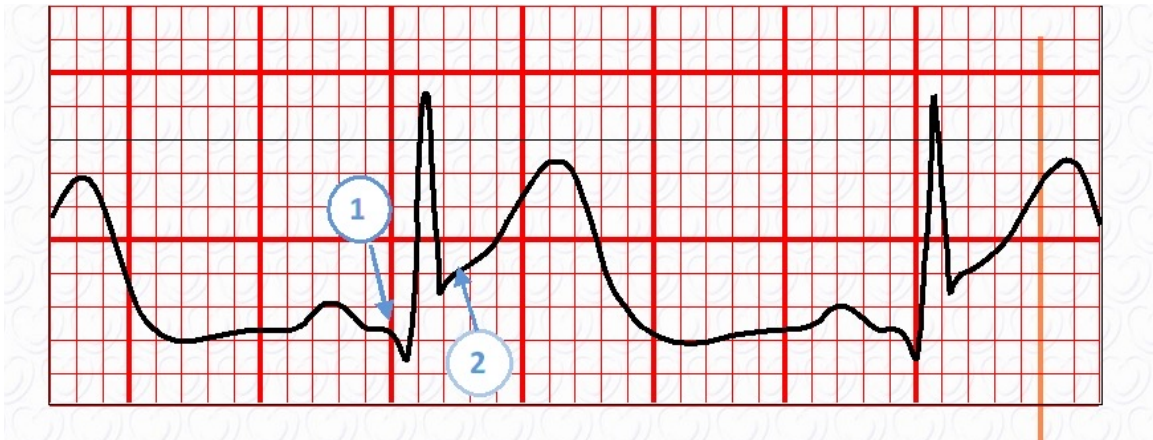
Arrow 1 indicates the onset of the Q wave. Arrow 2 Indicates the onset of the ST-segment or J-point. The difference between points 1 and 2 denotes the magnitude of the ST-segment elevation
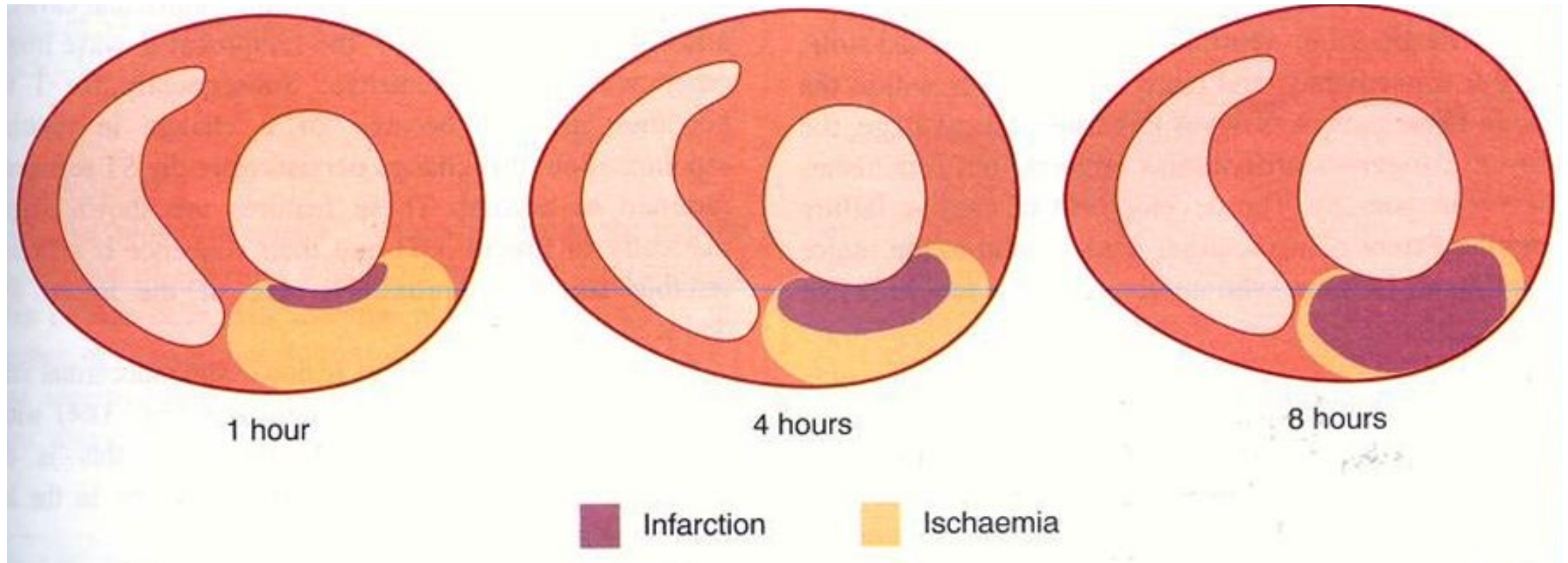
ST-segment depression in nstemi
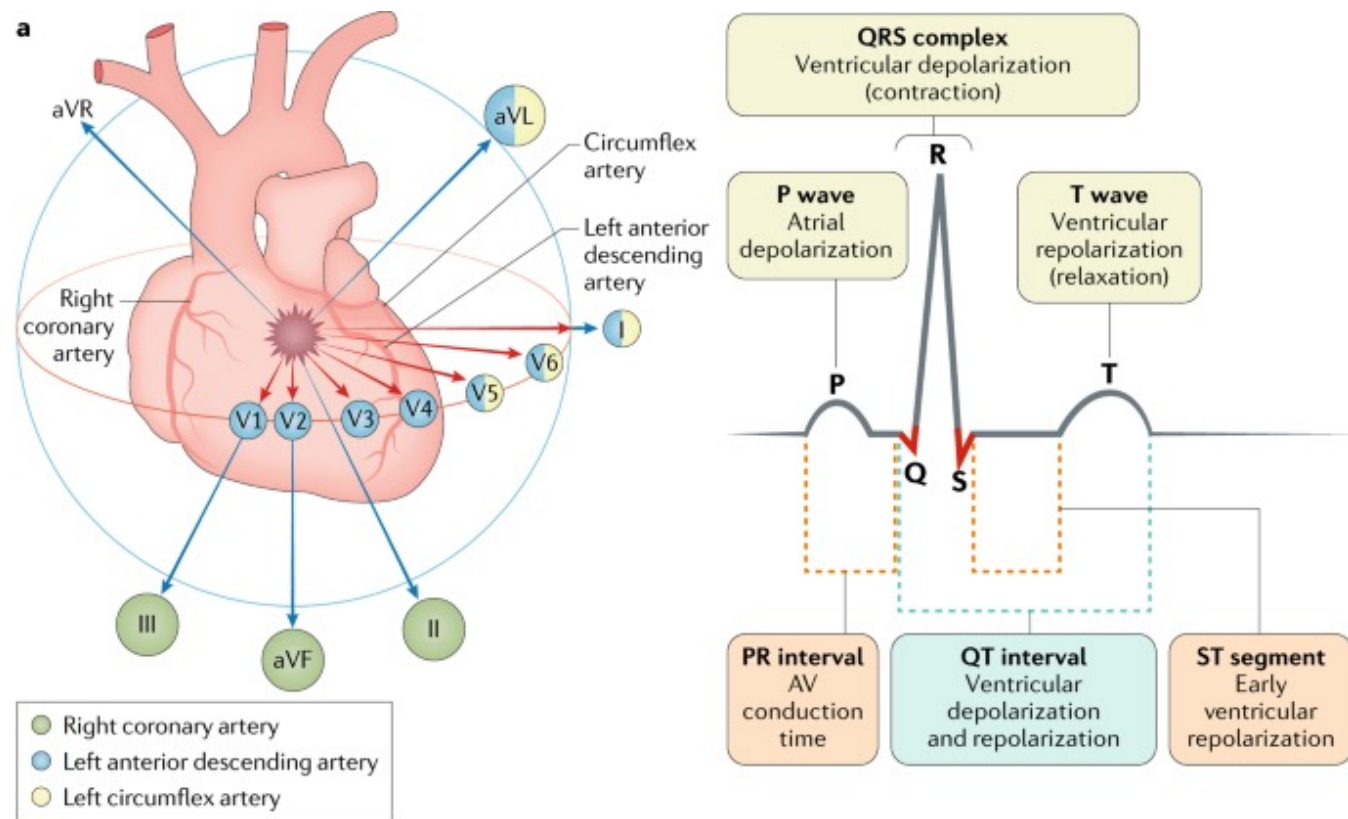
T-wave inversion in nstemi

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Time course of myocardial infarction

1 hour   4 hours   8 hours

■ Infarction   ■ Ischaemia

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Time course of electrocardiographic changes

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Myocardial infarction type 1
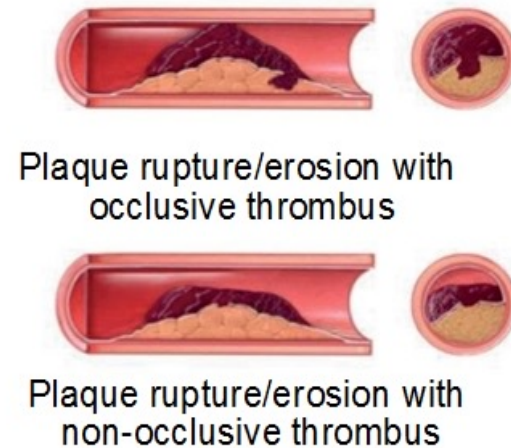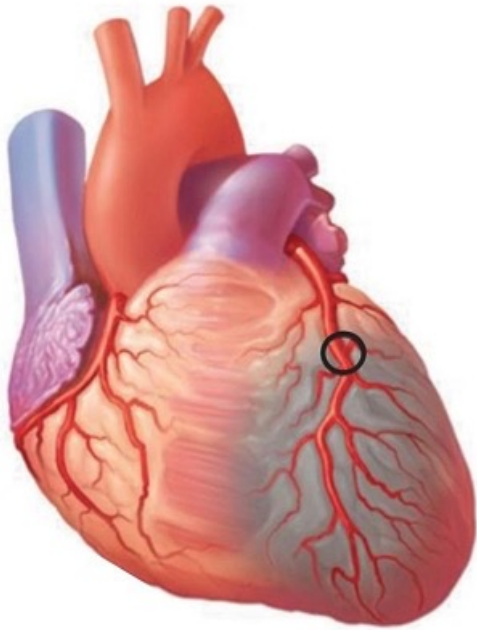
Plaque rupture/erosion with occlusive thrombus

Plaque rupture/erosion with non-occlusive thrombus

- Symptoms of acute myocardial infarction
- New ischemic ECG changes
- Developing of pathological Q waves
- Imaging evidence of new loss of viable myocardium or new wall motion abnormality in a pattern consistent with ischaemic etiology
- Identification of a coronary thrombus by angioplasty including intracoronary imaging or by autopsy

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Myocardial infarction type 2

Atherosclerosis and oxygen supply/demand imbalance

Vasospasm or coronary microvascular dysfunction

Non-atherosclerotic coronary dissection

Oxygen supply/demand imbalance alone
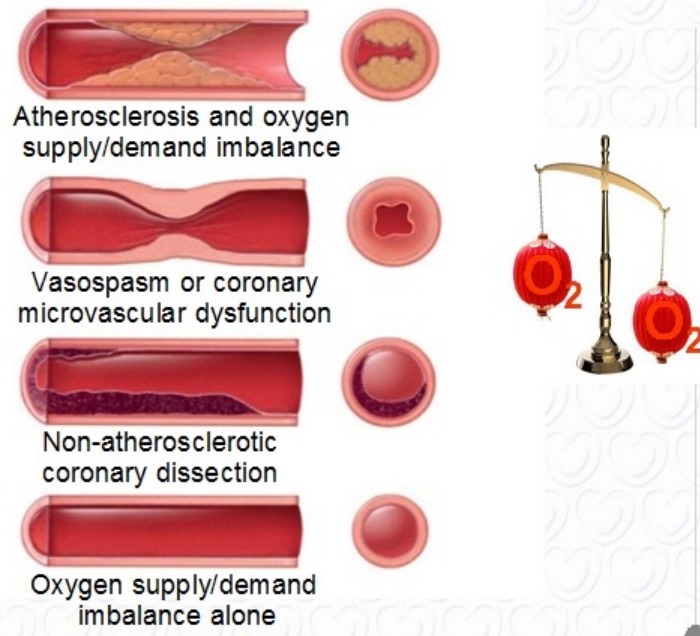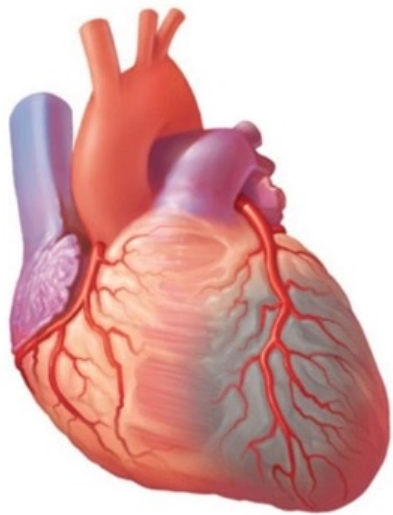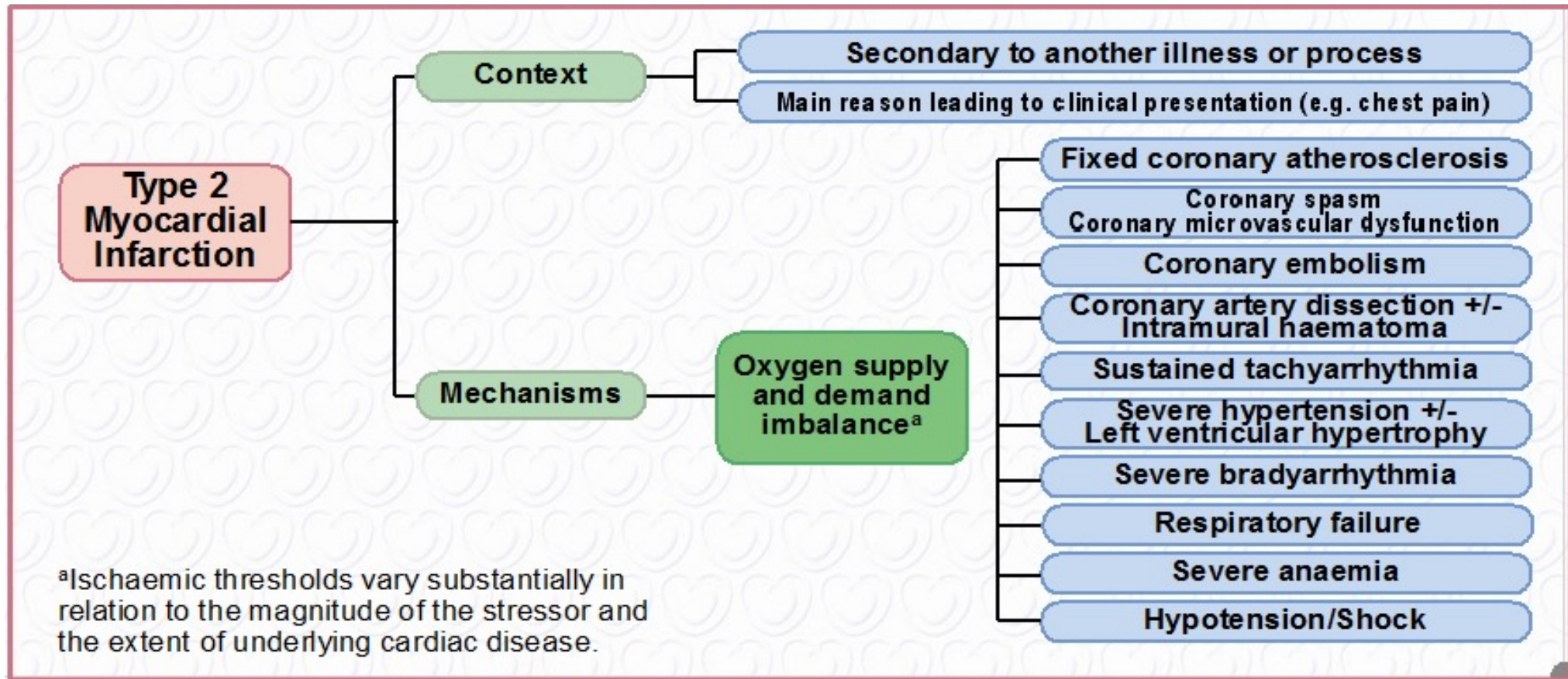
- Symptoms of acute myocardial infarction
- New ischemic ECG changes
- Developing of pathological Q waves
- Imaging evidence of new loss of viable myocardium or new wall motion abnormality in a pattern consistent with ischaemic etiology

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Myocardial infarction type 2

4th joint ESC/ACC/AHA/WHF definition of myocardial infarction.
Eur Heart J 2019; 40: 237-69

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Myocardial infarction type 3
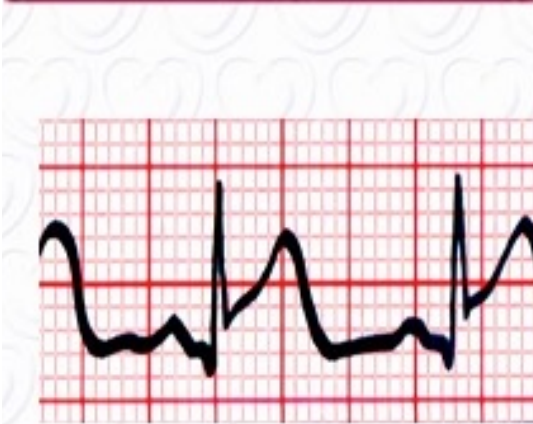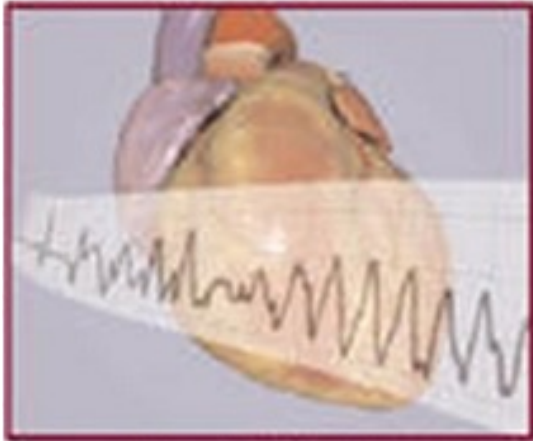
Patients who suffer **cardiac death**, with symptoms suggestive of myocardial ischaemia accompanied by presumed new ischaemic ECG changes or ventricular fibrillation, but die before blood samples for biomarkers can be obtained, or before increases in cardiac biomarkers can be identified or myocardial infarction detected by autopsy examination

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Myocardial infarction type 4a

Isolated development of new Q waves meets the criteria if cTn values are elevated and rising but less than the pre-specified thresholds for PCI

PCI-related MI<=48 h after the index procedure is defined by elevation of cardiac troponin values >5 times 99th percentile URL. In addition, either

- New ischemic ECG changes
- Imaging evidence of new loss of viable myocardium or new wall motion abnormality in a pattern consistent with ischaemic etiology
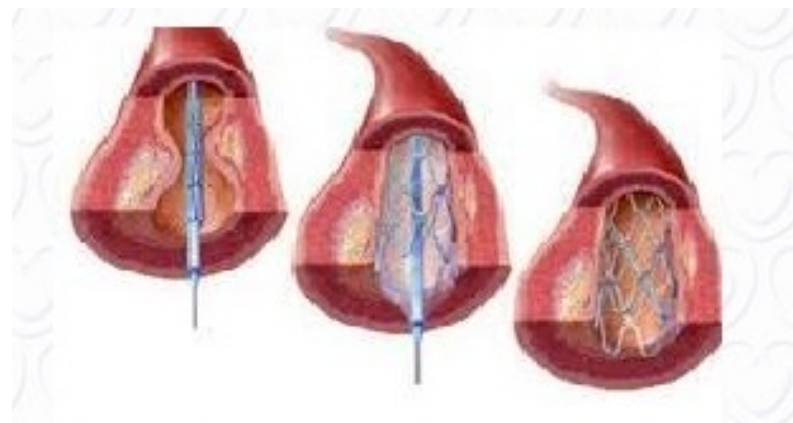- Angiographic findings consistent with a procedural flow-limiting complication such as coronary dissection, occlusion of a major epicardial artery or a side branch occlusion/thrombus, disruption of collateral flow or distal embolization

If cTnI values are not > 5x 99th percentile URL →myocardial injury.

4th joint ESC/ACC/AHA/WHF definition of myocardial infarction. Eur Heart J 2019; 40: 237-69

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Myocardial infarction type 4b
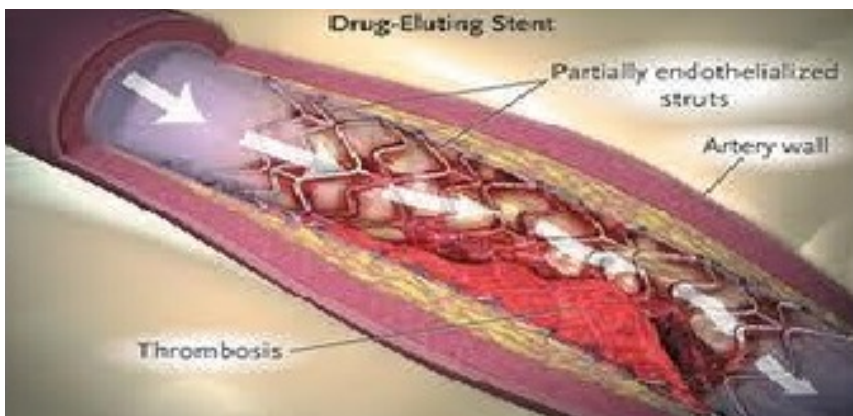
Myocardial infarction related to **stent thrombosis** is detected by coronary angiography or autopsy in the setting of myocardial ischaemia and with a rise and/or fall of cardiac troponin values with at least one value >99th percentile URL.

The following temporal categories are suggested:
- Acute, 0-24 h
- Subacute, >24h to 30 days
- Late, > 30 days to 1 year
- Very late, > 1 year

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Myocardial infarction type 4c
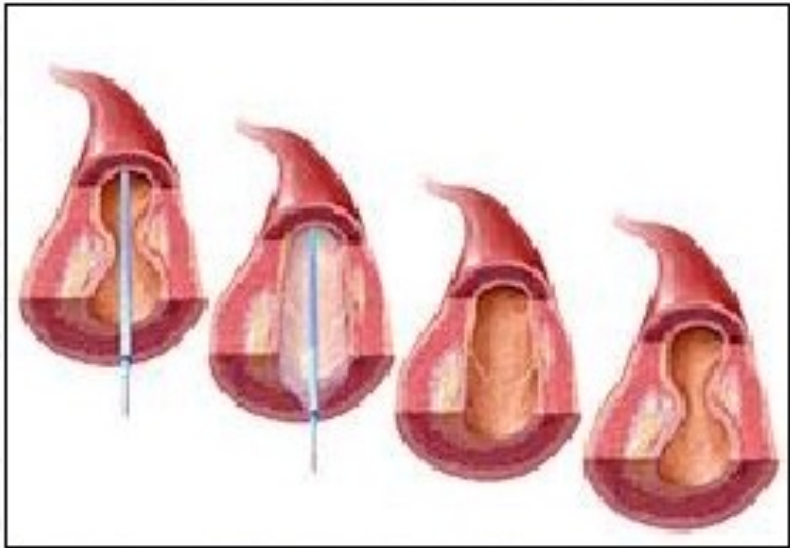
Myocardial infarction related to **in-stent stenosis, or restenosis** following balloon angioplasty in the infarct territory is detected by coronary angiography in the setting of myocardial ischaemia and with a rise and/or fall of cardiac troponin values with at least one value >99th percentile URL.

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Myocardial infarction type 5
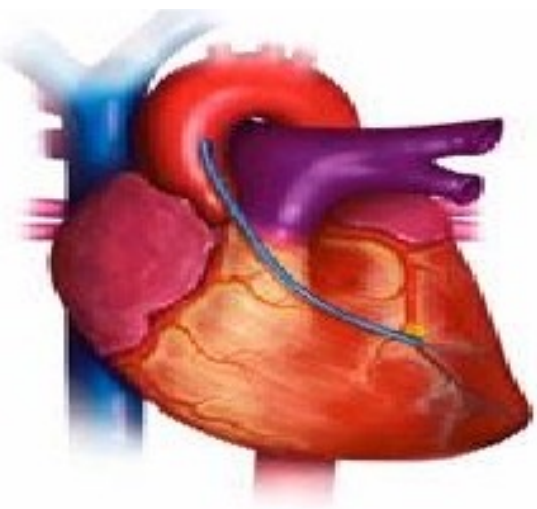
Isolated development of new Q waves meets the criteria if cTn values are elevated and rising but less than the pre-specified thresholds for CABG

CABG-related MI<=48 h after the index procedure is defined by elevation of cardiac troponin values >10 times 99th percentile URL. In addition, either

- New pathological Q waves or
- Angiographic documented new graft or new native coronary artery occlusion, or
- Imaging evidence of new loss of viable myocardium or new wall motion abnormality in a pattern consistent with ischaemic etiology

If cTnI values are not > 5x 99th percentile URL →myocardial injury.

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Myocardial infarction management (Time is muscle!)

Occluded coronary artery

Ischemic area

Time 0
Total occlusion leads to transmural ischemia.

20 minutes
Infarction commences in the subendocardium, from where it spreads like a wave front in water towards the epicardium.

Expansion of infarction
The infarct area expands gradually as ischemic myocardium dies.

2–12 hours
If the occlusion is not resolved within 2 to 12 hours the entire ischemic area will become necrotic.

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Management of suspected myocardial infarction patients in E.R.

- 12-lead ECG recording (+ addition right leads)
- Blood tests with myocardial injury markers
- Continuous ECG monitoring
- Continuous blood pressure monitoring
- O_2 supply only if O_2 saturation <90% or PaO_2<60 mm Hg
- Titrated i.v. opioids considered to relief pain
- Mild tranquillizer (usually benzodiazepine) should be considered in very anxious patients

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STEMI management

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STEMI management

Ibanez B, et al. Eur Heart J 2017; doi: 10.1093/eurheartj/ehx095

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NSTEMI management

Symptom onset

First medical contact → NSTE-ACS diagnosis

PCI center — YES

EMS or Non-PCI center

Risk Identification

YES → Very High → YES

Immediate transfer to PCI center

EMS or Non-PCI center — YES → Very High

Same day transfer → High

High — YES

Low — YES

Therapeutic strategy

Immediate invasive (< 2 h)

Early Invasive (< 24 h)

Selective Invasive

Risk Category

Very high risk
- Haemodynamic instability
- Cardiogenic shock
- Recurrent/refractory chest pain despite medical treatment
- Life-threatening arrhythmias
- Mechanical complications of MI
- Acute heart failure clearly related to NSTE-ACS
- ST-segment depression >1 mm/6 leads plus ST-segment elevation aVr and/or V1

High risk
- Established NSTEMI diagnosis
- Dynamic new or presumably new contiguous ST/T-segment changes (symptomatic or silent)
- Resuscitated cardiac arrest without ST-segment elevation or cardiogenic shock
- GRACE risk score >140

Low risk
Lack of any of the very high or high risk characteristics

Collet JP et al. Eur Heart J 2020; doi: 10.1093/eurheartj/ehaa575

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NSTEMI management (GRACE risk score)

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STEMI management (reperfusion strategy terminology)

Term	Definition
Primary PCI strategy	Emergent coronary angiography and PCI of the IRA if indicated.
Rescue PCI	Emergent PCI performed as soon as possible in the case of failed fibrinolytic treatment.
Routine early PCI strategy after fibrinolysis	Coronary angiography, with PCI of the IRA if indicated, performed between 2 and 24 hours after successful fibrinolysis.
Pharmacoinvasive strategy	Fibrinolysis combined with rescue PCI (in case of failed fibrinolysis) or routine early PCI strategy (in case of successful fibrinolysis).

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THANK YOU!

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