Initial evaluation and management of suspected ACS in the emergency department

M.Hajikarimi

Interventional Cardiologist

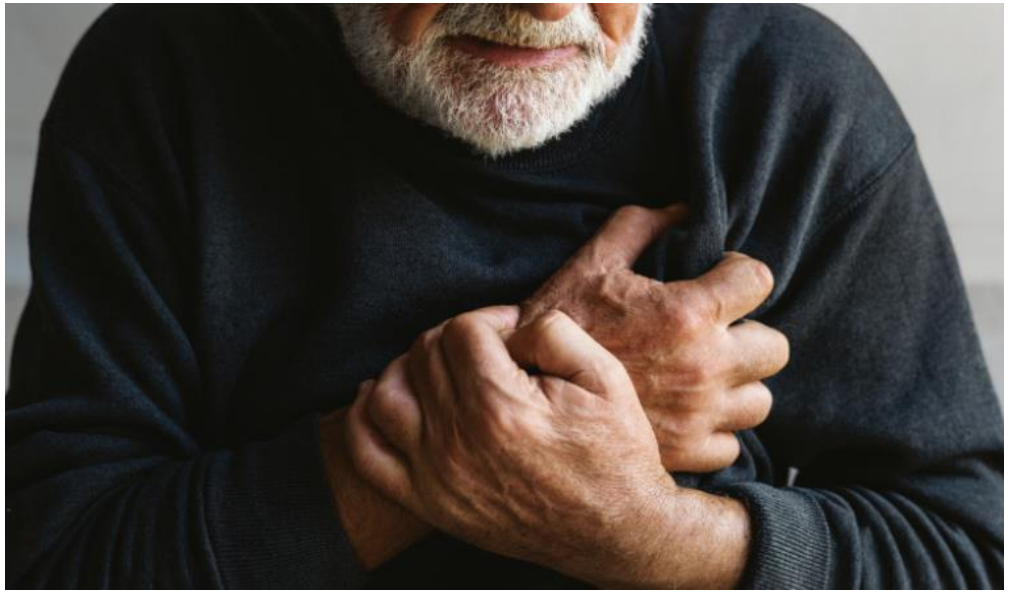
When to suspect ACS

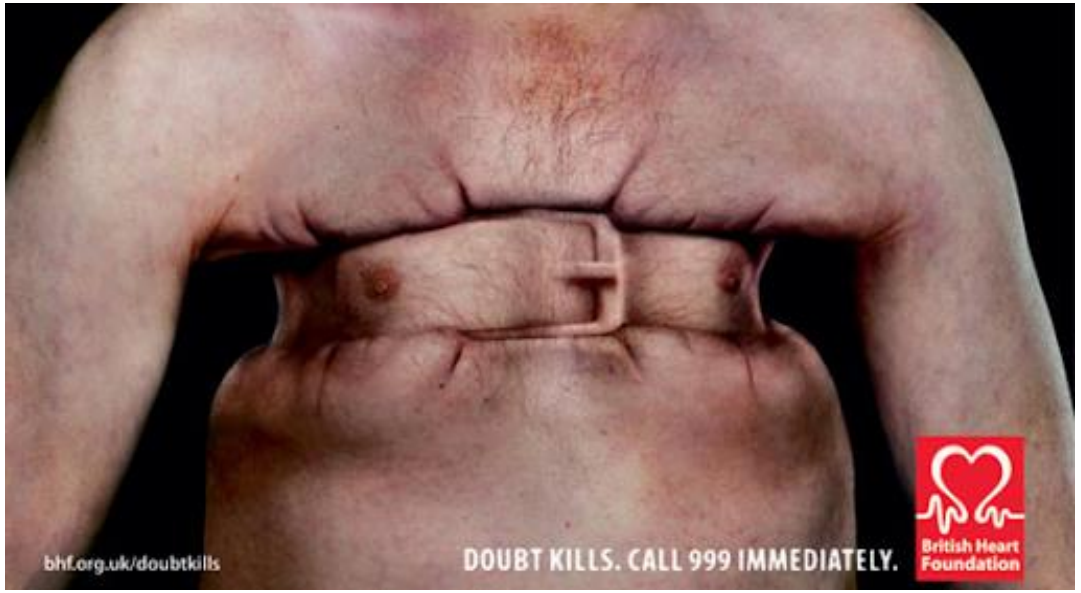
- Non focal chest discomfort or pressure rather than pain and is exacerbated by activity
- Discomfort that radiates to either or both arms
- Many patients with ACS present with symptoms such as dyspnea or malaise
- Patients who are older or have diabetes are more likely to present with dyspnea without chest pain

OPQRST

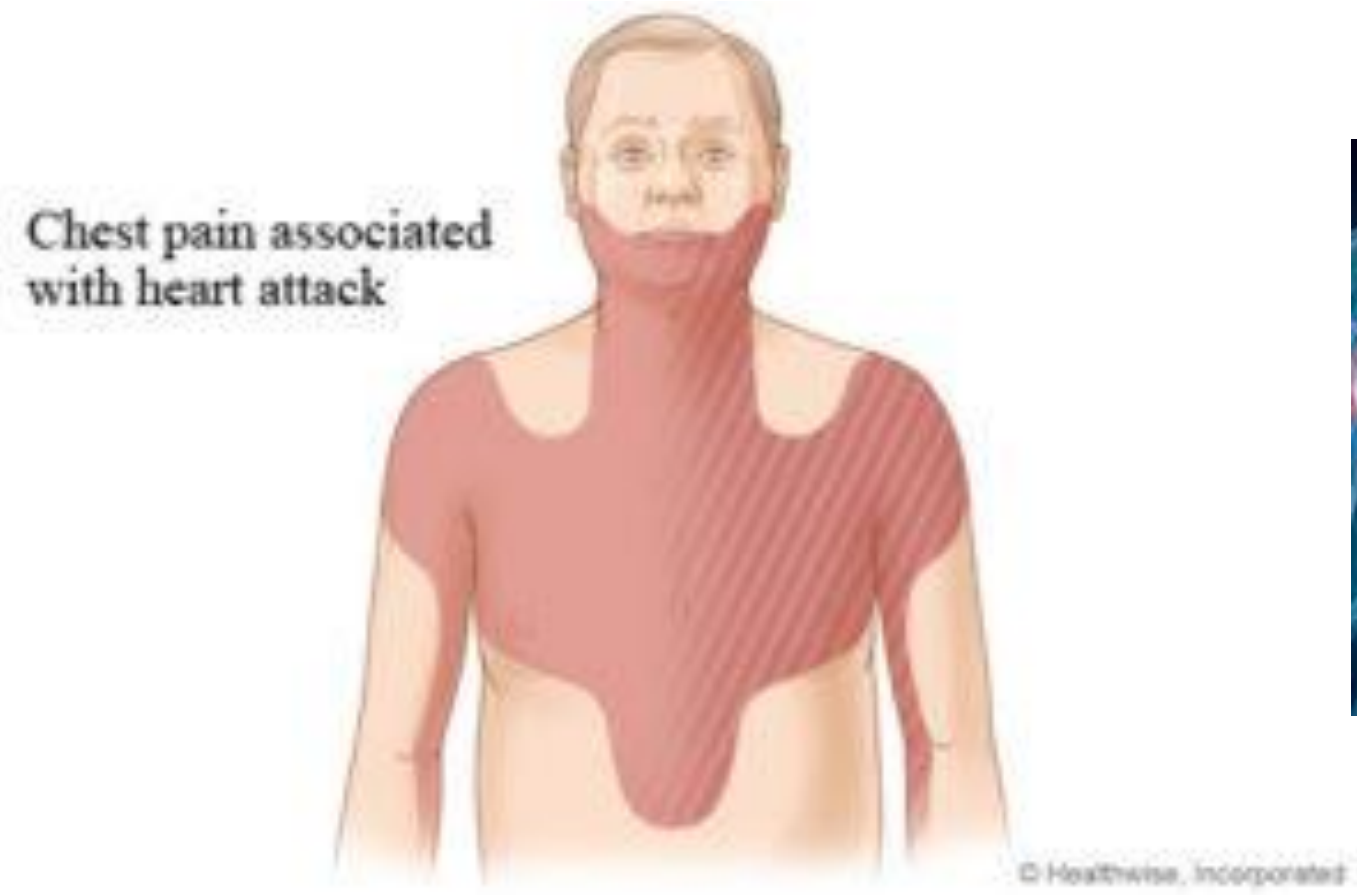
- Onset
- Provocation and palliation
- Quality
- Radiation
- Site
- Time course

Levine sign




bhf.org.uk/doubtkills
DOUBT KILLS. CALL 999 IMMEDIATELY.
British Heart Foundation

Symptoms associated with the highest relative risk of MI

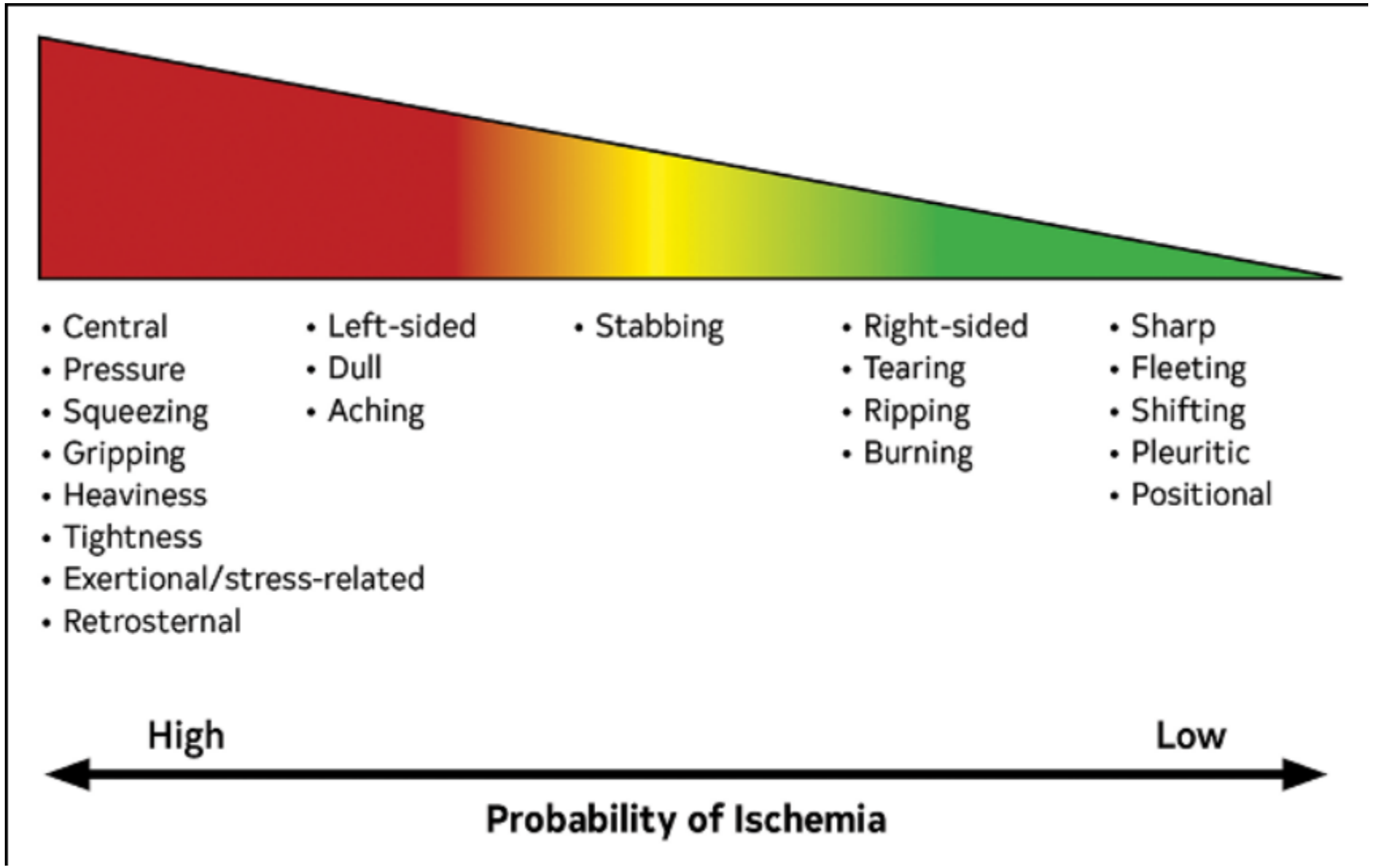


Historical features increasing likelihood ACS

- Patients with a prior history of ACS
- A prior history of other vascular disease
- Risk factors for ACS: age , male , sex , DM, HTN, DLP, cigarette smoking
- Recent use of cocaine or other sympthommetic

Characteristics are more typical of non ischemic chest pain

- Pleuritic pain
- Location in the mid or lower abdominal region
- Any discomfort localized with one finger
- Any discomfort reproduced by movement or palpation
- Constant pain lasting for days
- Feeling pains lasting for a few seconds or less
- Pain radiating into the lower extremities or above the mandible


• Central
• Pressure
• Squeezing
• Gripping
• Heaviness
• Tightness
• Exertional/stress-related
• Retrosternal
• Left-sided
• Dull
• Aching
• Stabbing
• Right-sided
• Tearing
• Ripping
• Burning
• Sharp
• Fleeting
• Shifting
• Pleuritic
• Positional
High
Low
Probability of Ischemia

Atypical presentation

- Dyspnea alone
- Weakness
- Nausea and or vomiting
- Epigastric pain or discomfort
- Palpitation
- Syncope
- Cardiac arrest

Signs and Symptoms of ACS

Typical

- Chest pain (discomfort, pressure, tightness, squeezing, crushing, ache, burning, fullness, etc.)
- Radiation (neck, jaw, shoulder, arm pain/numbness)
- Shortness of breath
- Nausea/vomiting
- Diaphoresis at rest
- Lightheadedness

Atypical

- Generalized weakness
- Excessive fatigue
- Syncope
- Altered mental state
- Abdominal pain
- Feeling of fullness
- Palpitations
- Back pain
- Loss of appetite or indigestion

Causes of CP that pose an immediate threat to life

- Acute aortic dissection
- Pulmonary embolism
- Tension pneumothorax
- Pericardial tamponade
- Mediastinitis(esophageal rupture)

Physical examination

- Responsiveness , air way , breathing and circulation
- Evidence of systemic hypo perfusion
- Evidence of heart failure
- Focused neurologic examination

Table 4. Physical Examination in Patients With Chest Pain

Clinical Syndrome	Findings
Emergency	
ACS	Diaphoresis, tachypnea, tachycardia, hypotension, crackles, S3, MR murmur.[2]; examination may be normal in uncomplicated cases
PE	Tachycardia + dyspnea–>90% of patients; pain with inspiration[7]
Aortic dissection	Connective tissue disorders (eg, Marfan syndrome), extremity pulse differential (30% of patients, type A>B)[8] Severe pain, abrupt onset + pulse differential + widened mediastinum on CXR >80% probability of dissection[9] Frequency of syncope >10%[8], AR 40%–75% (type A)[10]
Esophageal rupture	Emesis, subcutaneous emphysema, pneumothorax (20% patients), unilateral decreased or absent breath sounds
Other	
Noncoronary cardiac: AS, AR, HCM	AS: Characteristic systolic murmur, tardus or parvus carotid pulse AR: Diastolic murmur at right of sternum, rapid carotid upstroke HCM: Increased or displaced left ventricular impulse, prominent *a* wave in jugular venous pressure, systolic murmur
Pericarditis	Fever, pleuritic chest pain, increased in supine position, friction rub
Myocarditis	Fever, chest pain, heart failure, S3
Esophagitis, peptic ulcer disease, gall bladder disease	Epigastric tenderness Right upper quadrant tenderness, Murphy sign
Pneumonia	Fever, localized chest pain, may be pleuritic, friction rub may be present, regional dullness to percussion, egophony
Pneumothorax	Dyspnea and pain on inspiration, unilateral absence of breath sounds
Costochondritis, Tietze syndrome	Tenderness of costochondral joints
Herpes zoster	Pain in dermatomal distribution, triggered by touch; characteristic rash (unilateral and dermatomal distribution)

Immediate emergency department intervention

- Rapid evaluation to determine if their symptoms are suggestive of ACS
- Assess and stabilize airway , breathing and circulation
- Establish Iv access
- attach cardiac and oxygen saturation
- Supplemental oxygen if O2 saturation < 90%
- Perform focused HX and examination
- Obtain 12 lead ECG within 10 min of arrival repeat every 10 to 15 min if initial ECG is non diagnostic but clinical suspicious remain high
- Obtain blood for cardiac biomarker , Hb, electrolyte, …..

Immediate emergency department intervention

- Give 3 sublingual nitroglycerin (0.4 mg) stat and every 5 min for 3 dose if patient has persistent CP, HTN, signs of HF if there is no sign of hemodynamic compromise (RV failure) and no use of PDE inhibitors
- pain relief with nitroglycerin in acute setting is not diagnostic
- Give ASA 325 mg (non enteric coated) to be chewed and swallowed if oral administration is not feasible give as rectal suppository
- Morphine is indicated for CP refractory to nitrate and other anti ischemic therapies (2-4 mg slow IV and every 5 to 15 min)

Immediate emergency department intervention

- Give beta blocker (metoprolol tartrate 25 mgr orally) if no signs of HF and not at high risk for HF and no signs of hemodynamic compromise , bradycardia , severe reactive air way disease
- Start high intensive statin RX(atorvastatin 80 , rosuvastatin 40)

ECG and ACS

- In general a resting ECG should be obtained in all adult with CP that dose not have an obvious non cardiac cause
- Who needs an ECG :

  1)any patient over 30 with CP

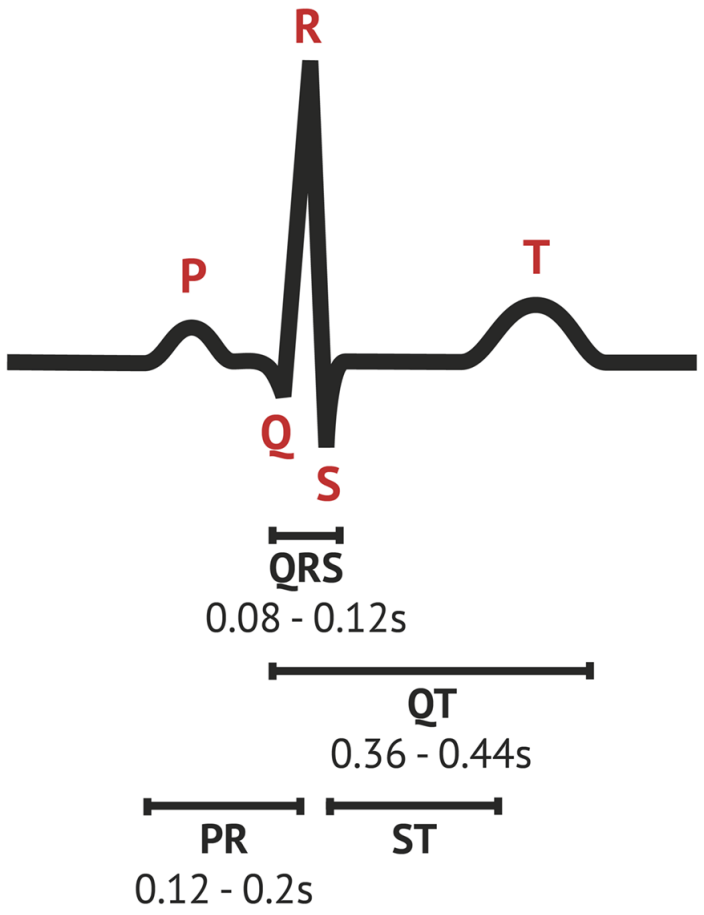
  2)any patient over 50 with any of following : dyspnea , altered mental status , upper extremity pain , syncope or weakness

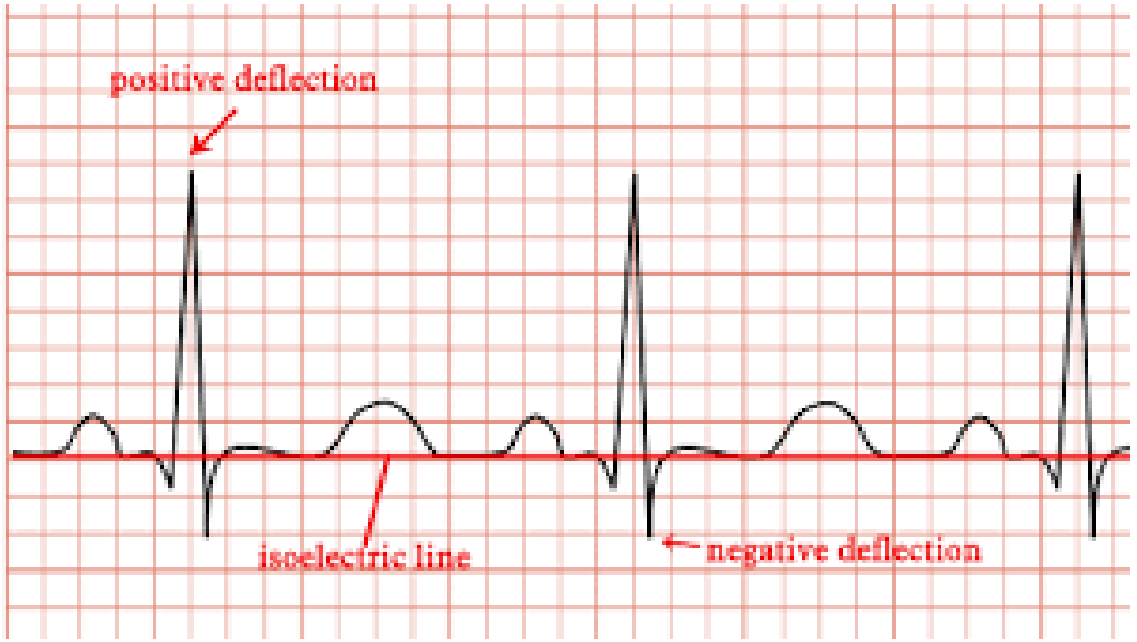
  3)any patient over 80 with abdominal pain , nausea or vomiting

41% of patient with NSTEMI do not have the typical ST depression or TWI

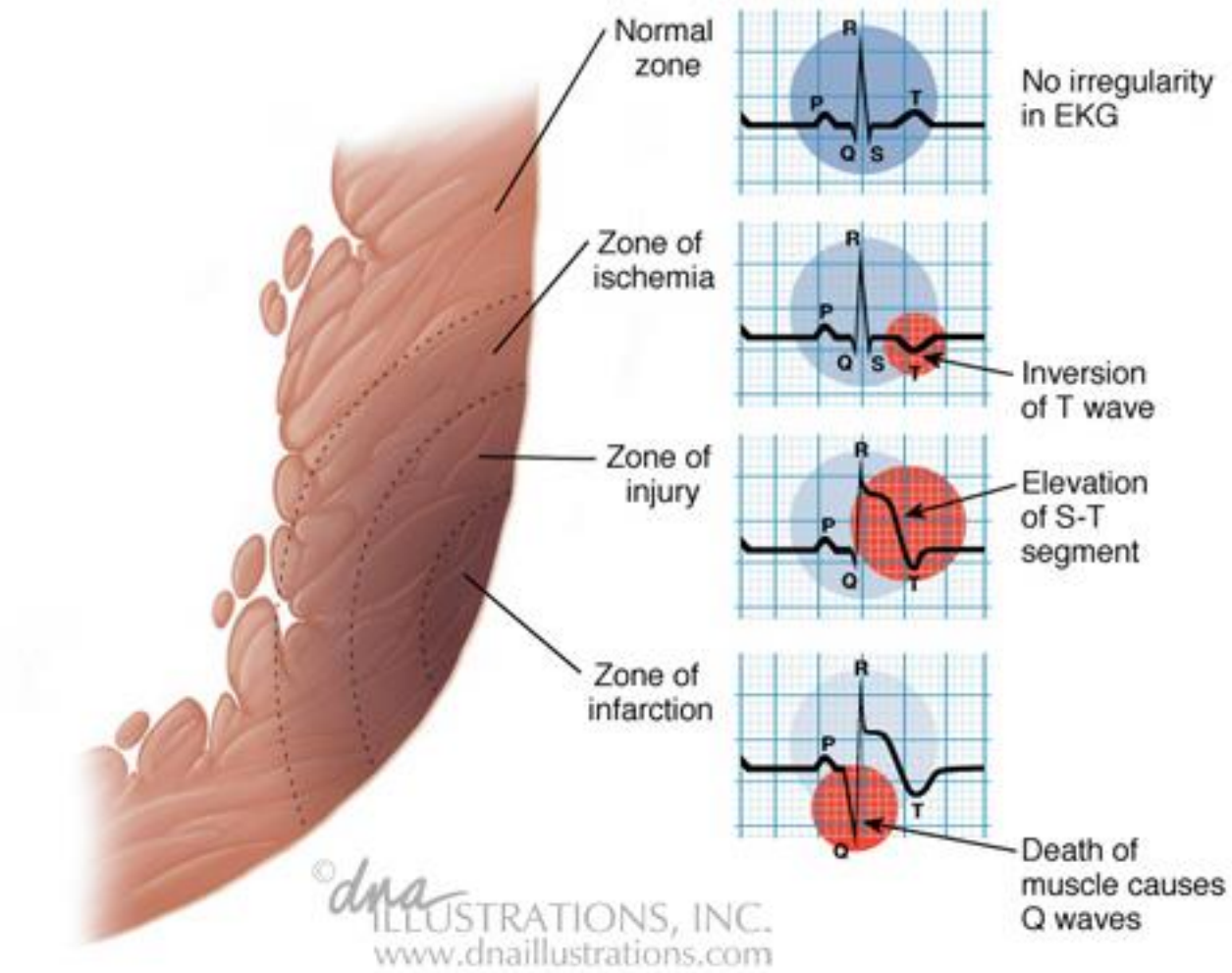
A normal ECG obtained while the patient experiencing CP can not R/O the possibility of ACS

Normal ECG


R
P
T
Q
S
QRS
0.08 - 0.12s
QT
0.36 - 0.44s
PR
ST
0.12 - 0.2s


positive deflection
isoelectric line
negative deflection

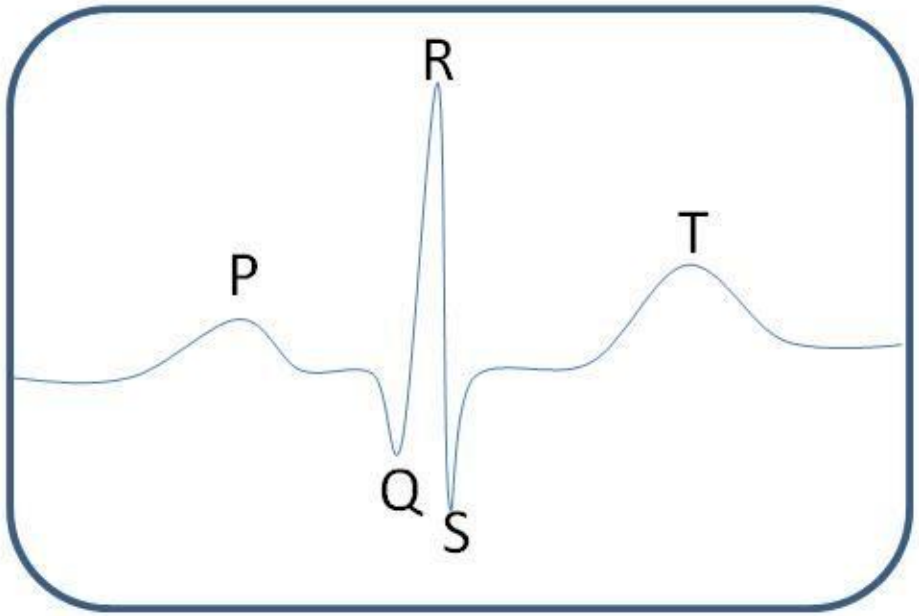
ECG in ACS


Normal zone
Zone of ischemia
Zone of injury
Zone of infarction
R
P
Q
S
T
No irregularity in EKG
Inversion of T wave
Elevation of S-T segment
Death of muscle causes Q waves
©dna ILLUSTRATIONS, INC.
www.dnaillustrations.com

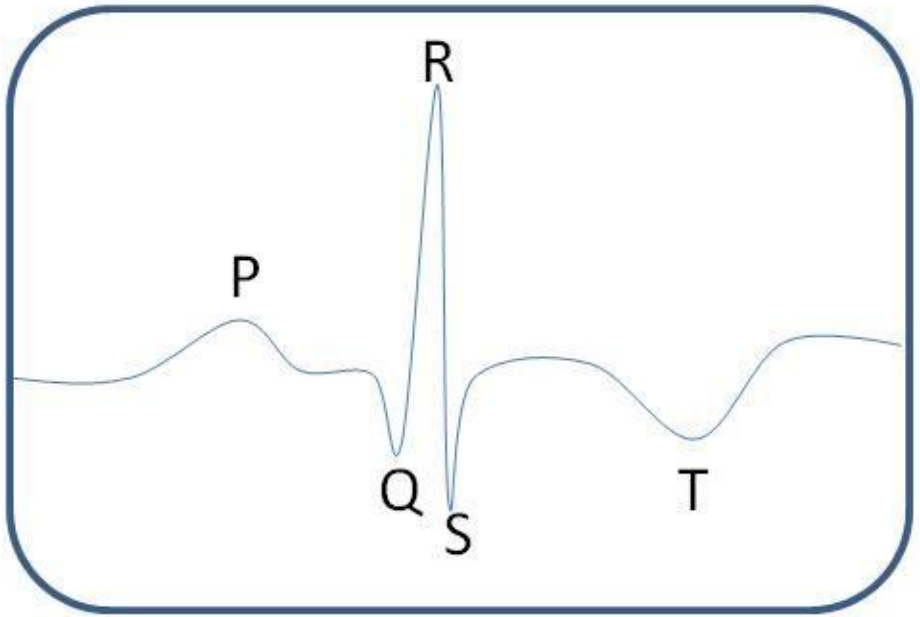
ECG finding consistent with NSTEMI

- New or presumed new horizontal or down sloping st depression > or = 0.05 mv in two anatomically contiguous leads
- T wave inversion > 0.1 mv in two anatomically contiguous leads with prominent R wave or R/S > 1

ECG in UA and NSTEMI

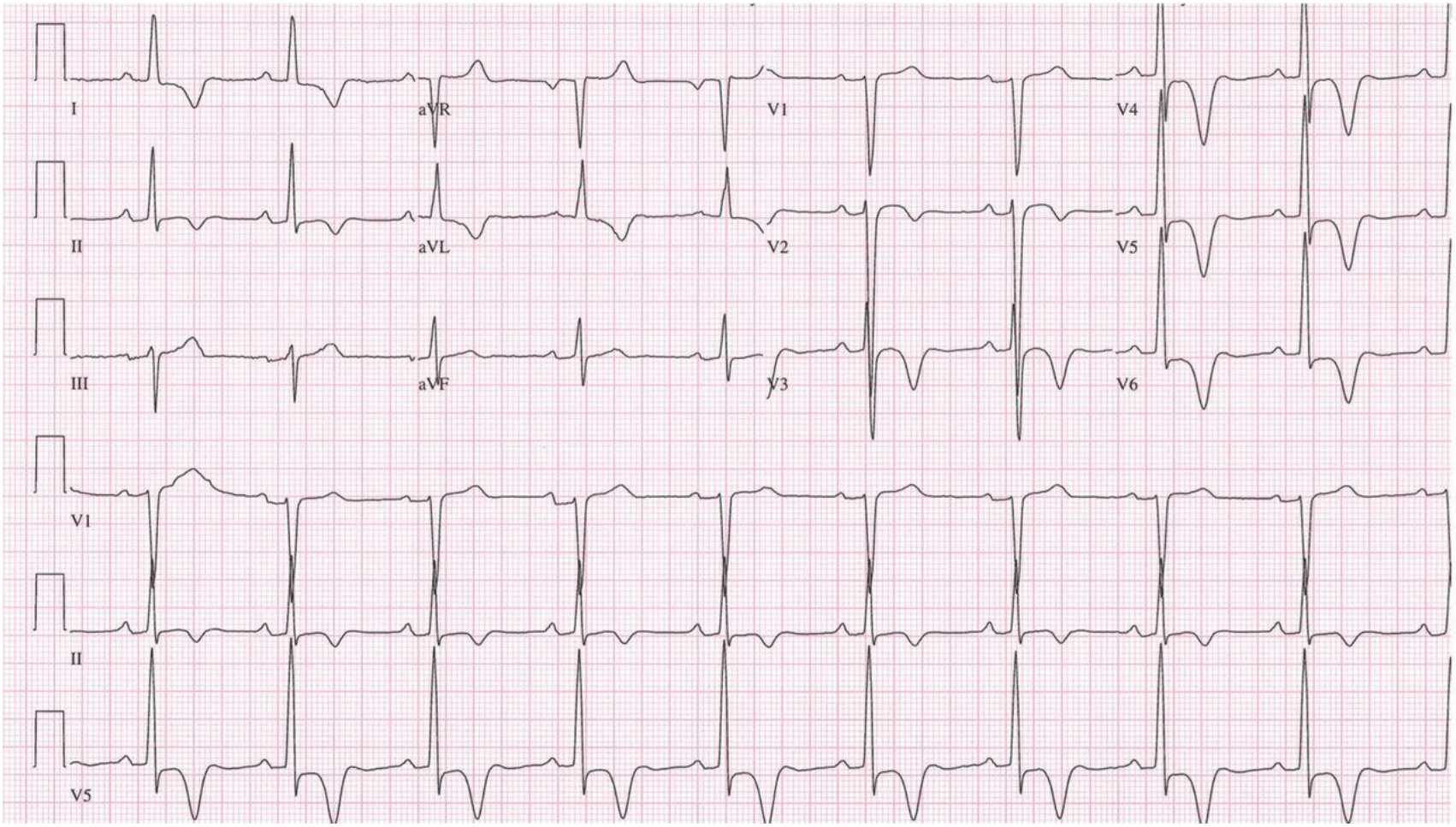


An ECG showing the normal P Q R S T waves

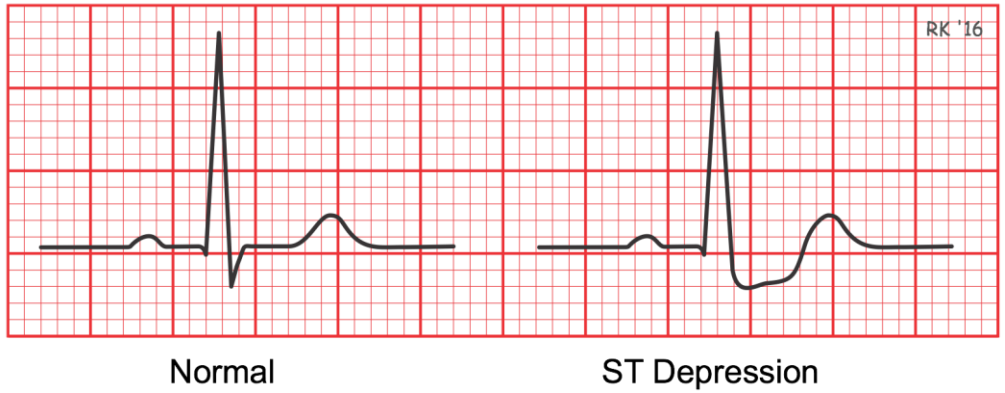


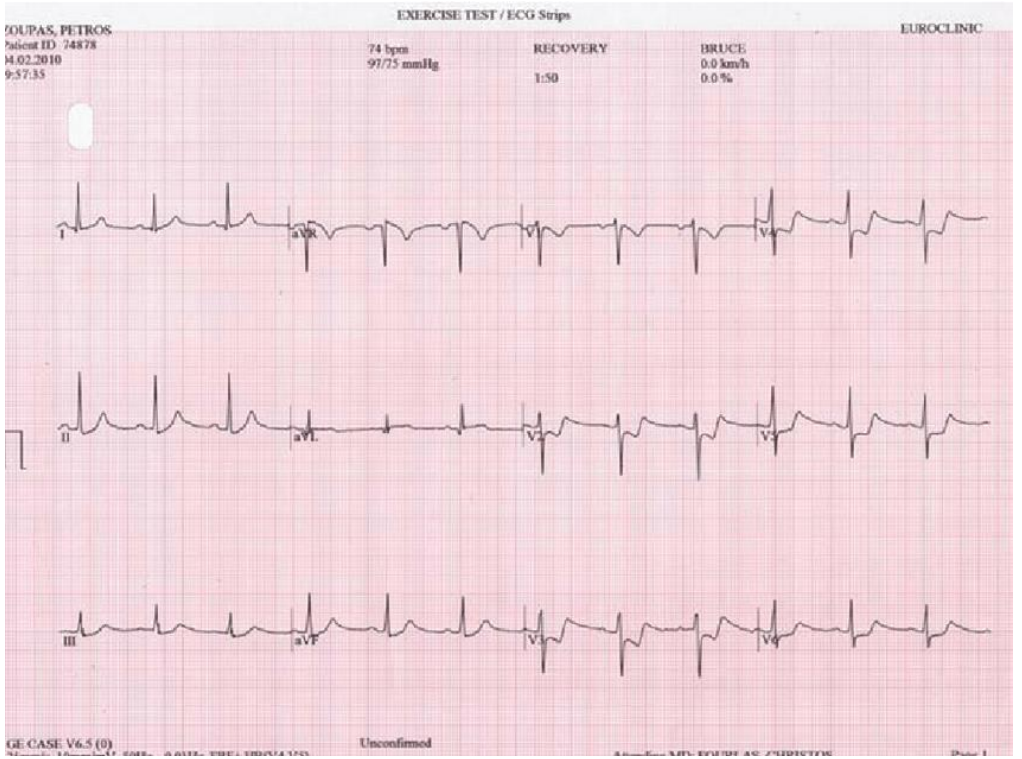
An ECG showing an inverted T-wave

ECG in UA and NSTEMI



ECG in UA and NSTEMI





ECG finding consistent with STEMI

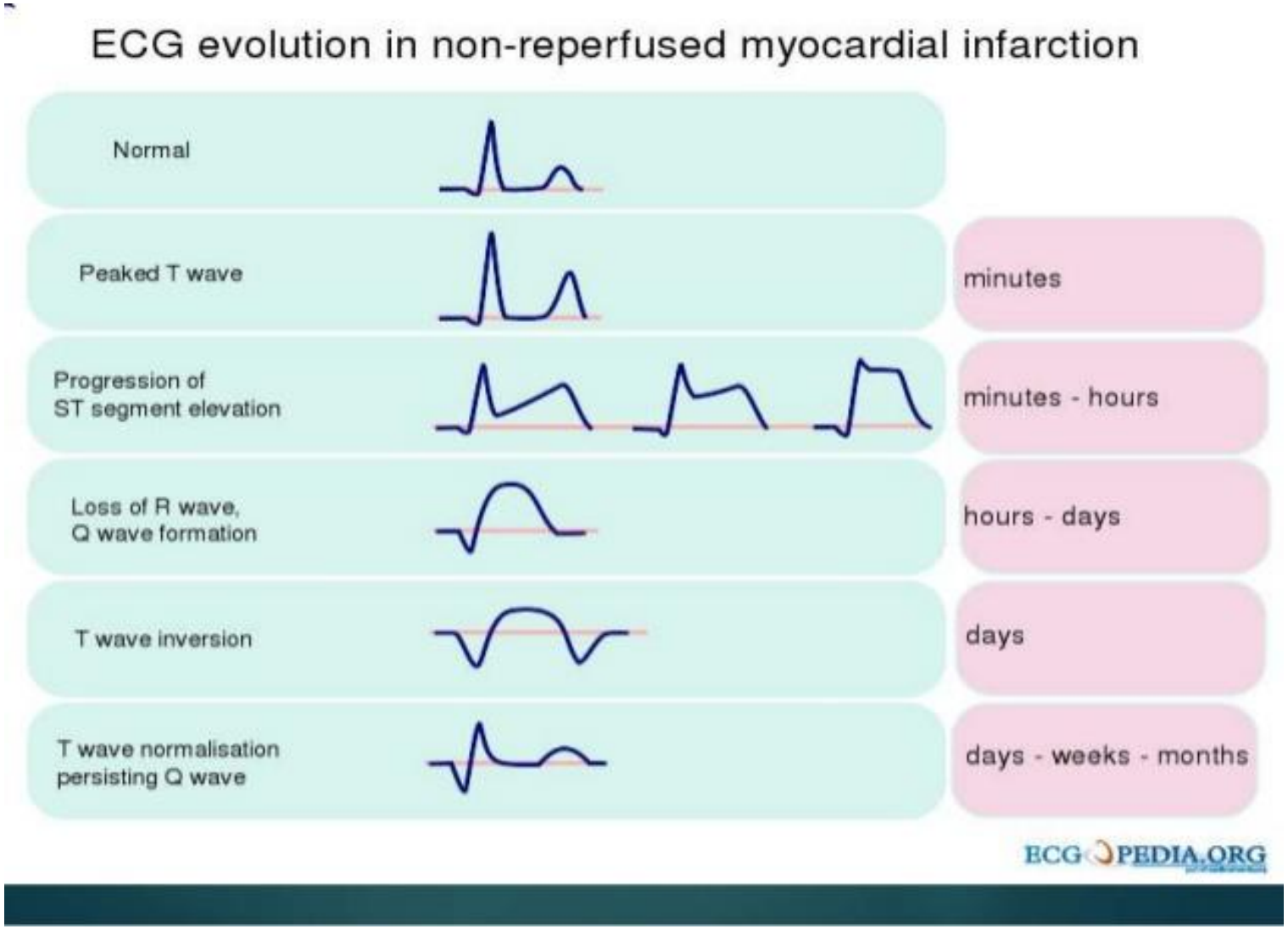
- > or = 0.1 mv ST elevation in all leads other than v2 to v3 at two anatomically contiguous leads
- In v2-v3 :

  > or = 0.2 mv in males > 40 years old

  > or = 0.25 mv in male < 40 years old

  > or = 0.15 mv in female

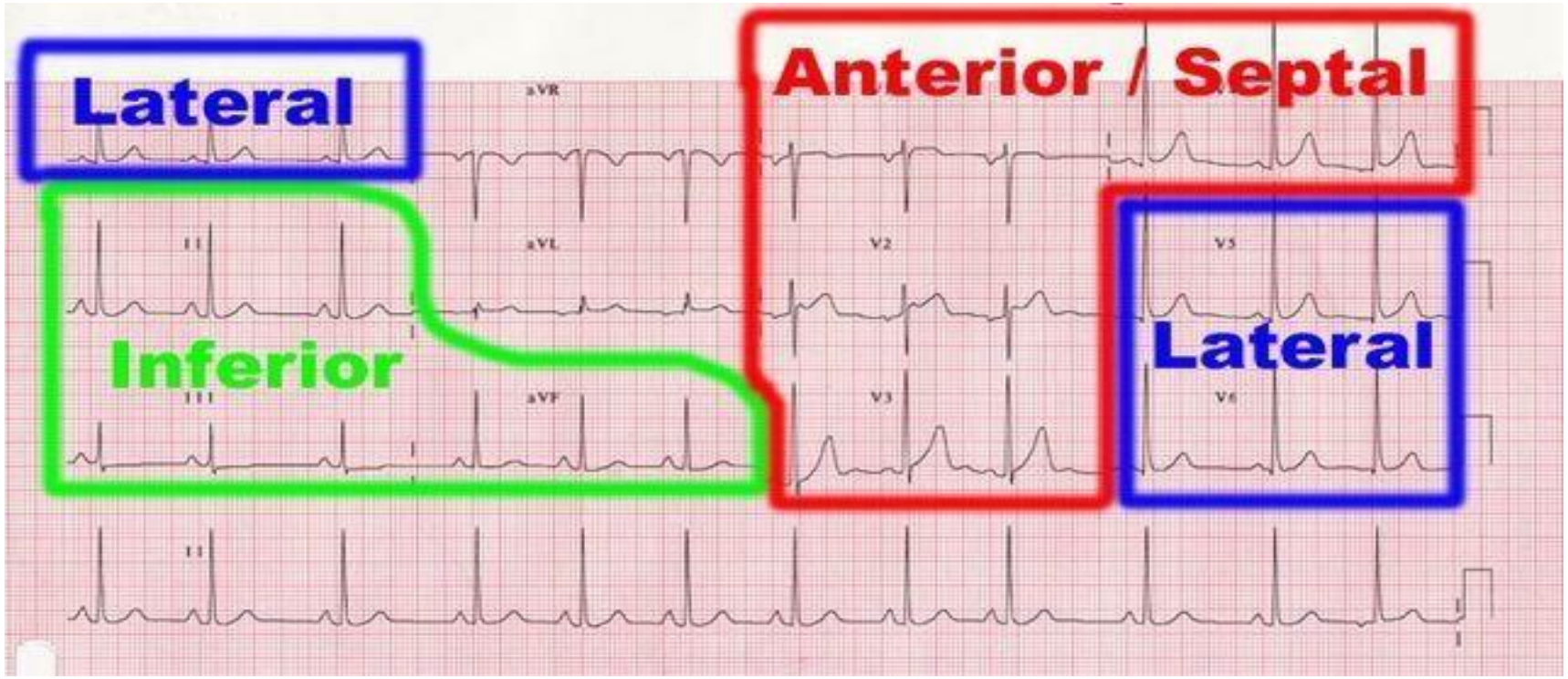
Evolution of STEMI in ECG



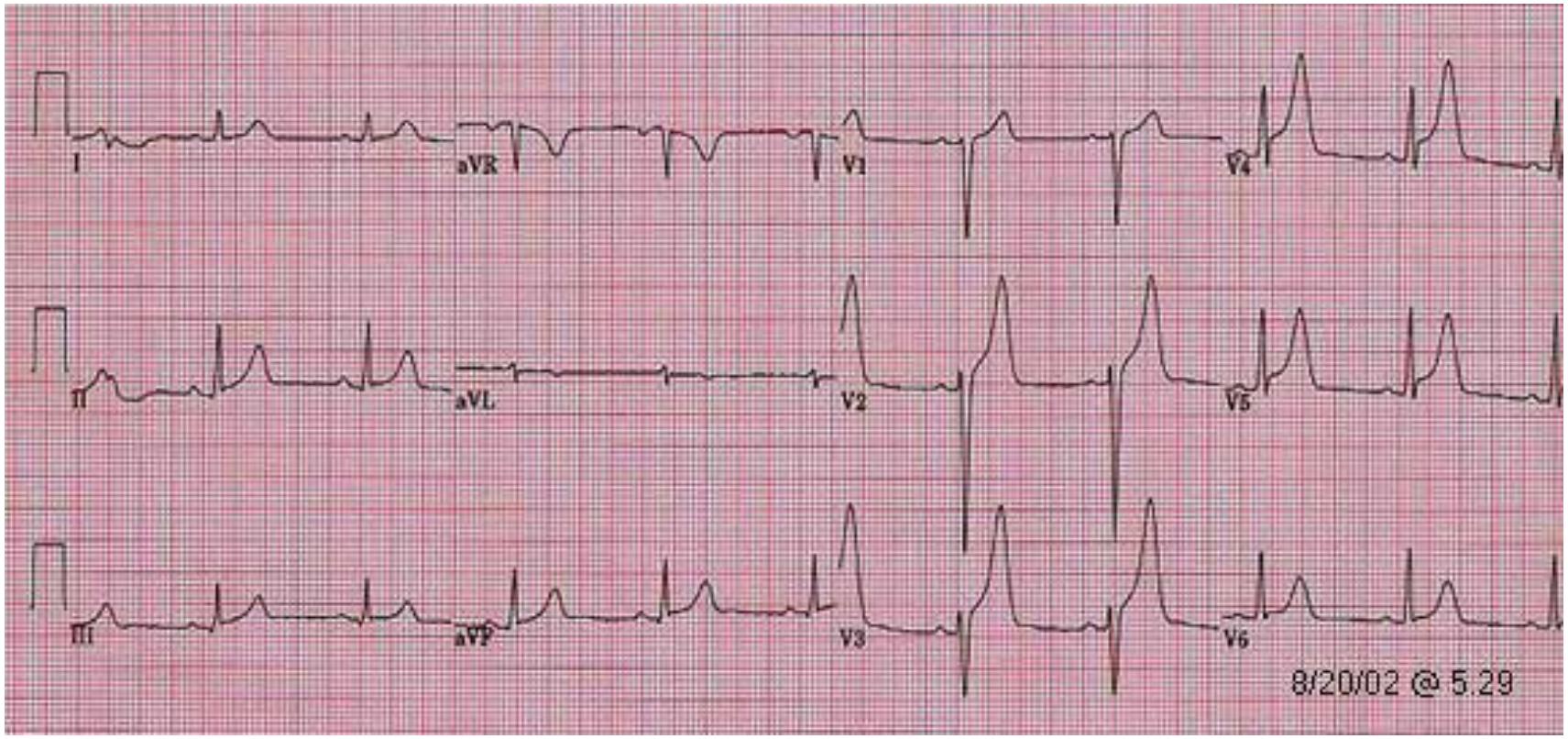
Localization of STEMI

- V1-v6 : anterior
- V1-v3 : anteroseptal
- I , avl , v4-v6: lat MI
- II, III, avf : inf MI
- V4R : Right MI
- V7-V9 : Post MI

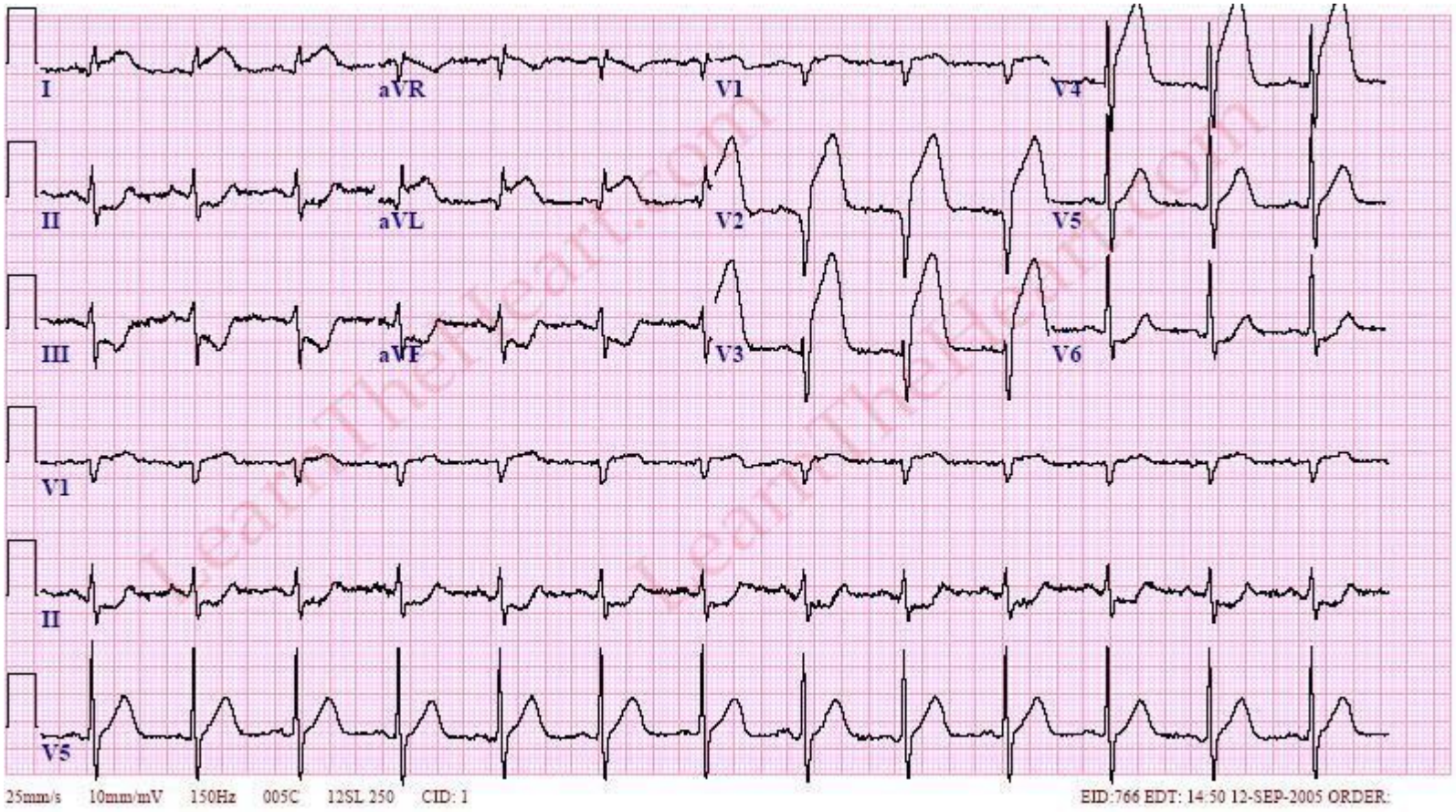
ECG


Lateral
Anterior / Septal
Inferior
Lateral
aVR
I
aVL
V2
V5
II
III
aVF
V3
V6
II

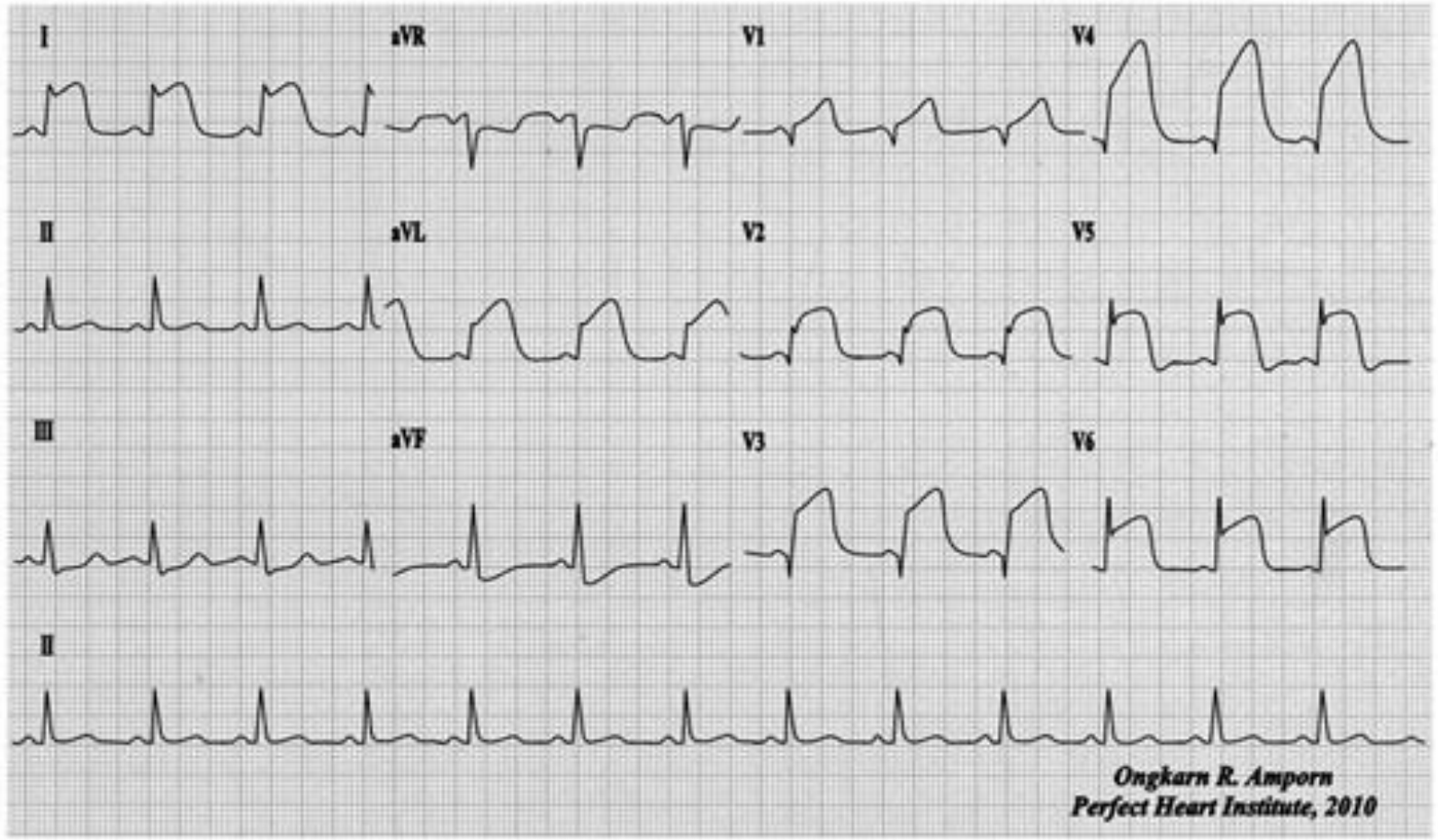
Hyperacute MI



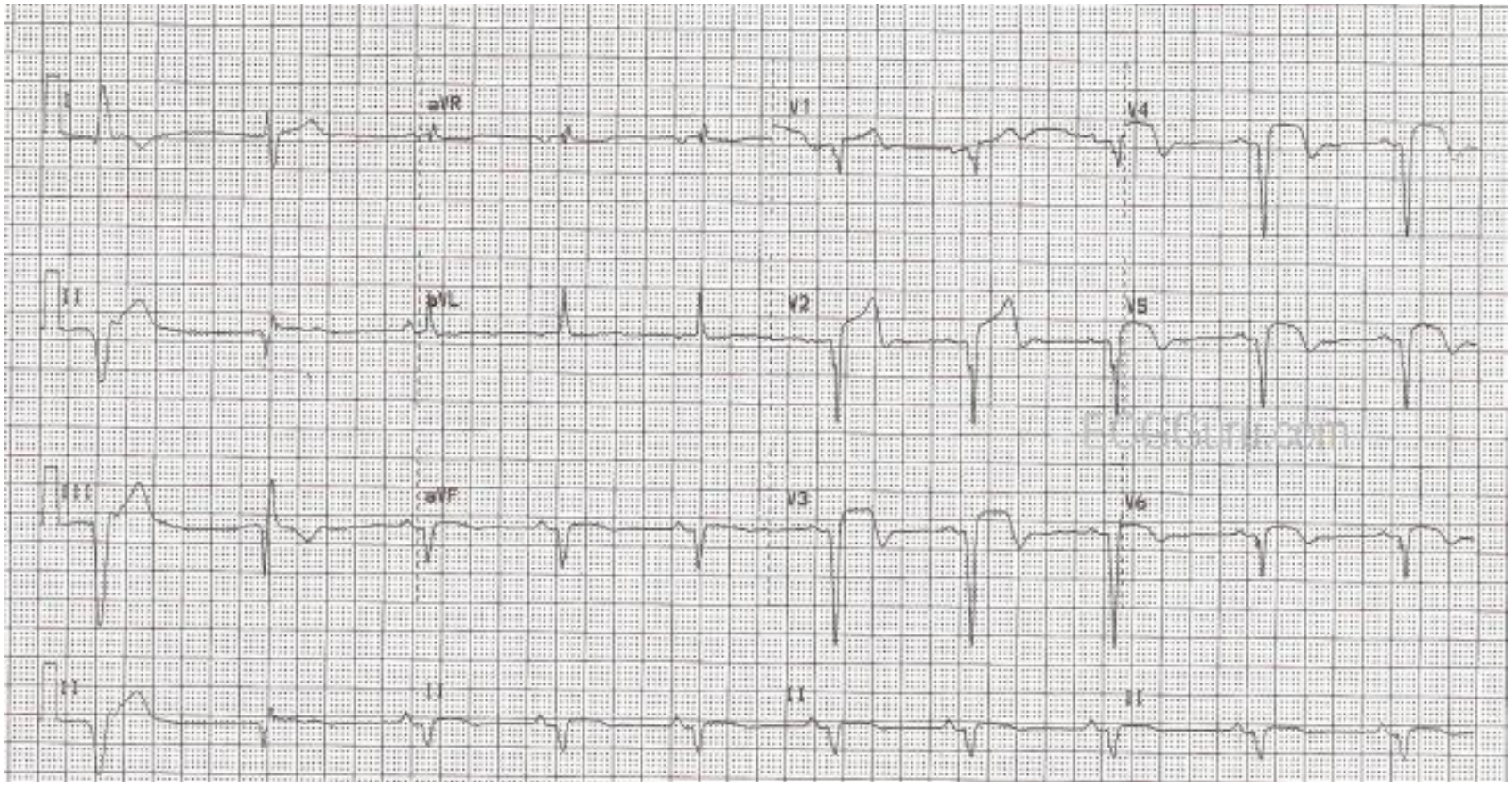
Acute MI


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25mm/s 10mm/mV 150Hz 005C 12SL 250 CID: 1
EID:766 EDT: 14:50 12-SEP-2005 ORDER:

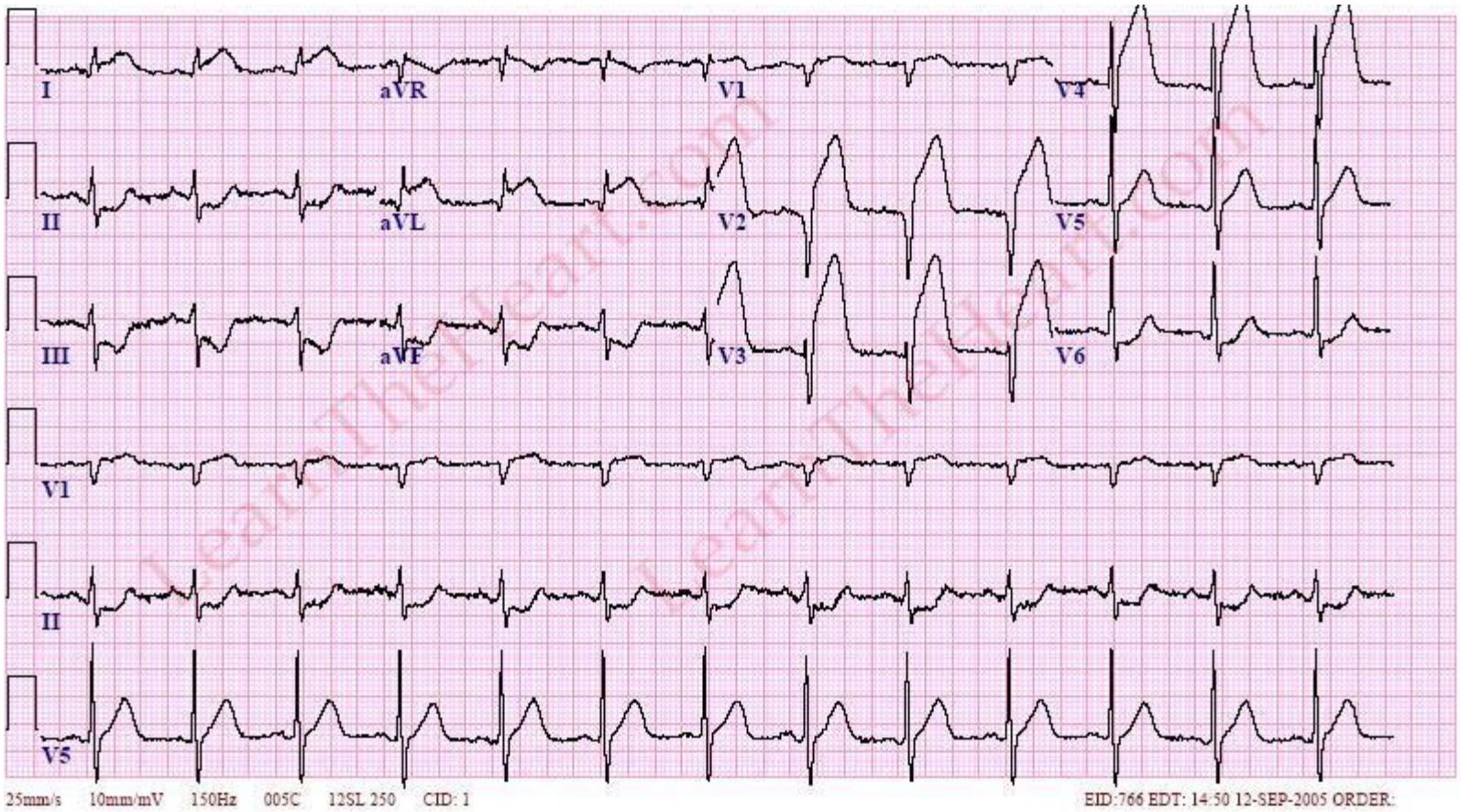
Acute MI


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Ongkarn R. Amporn
Perfect Heart Institute, 2010

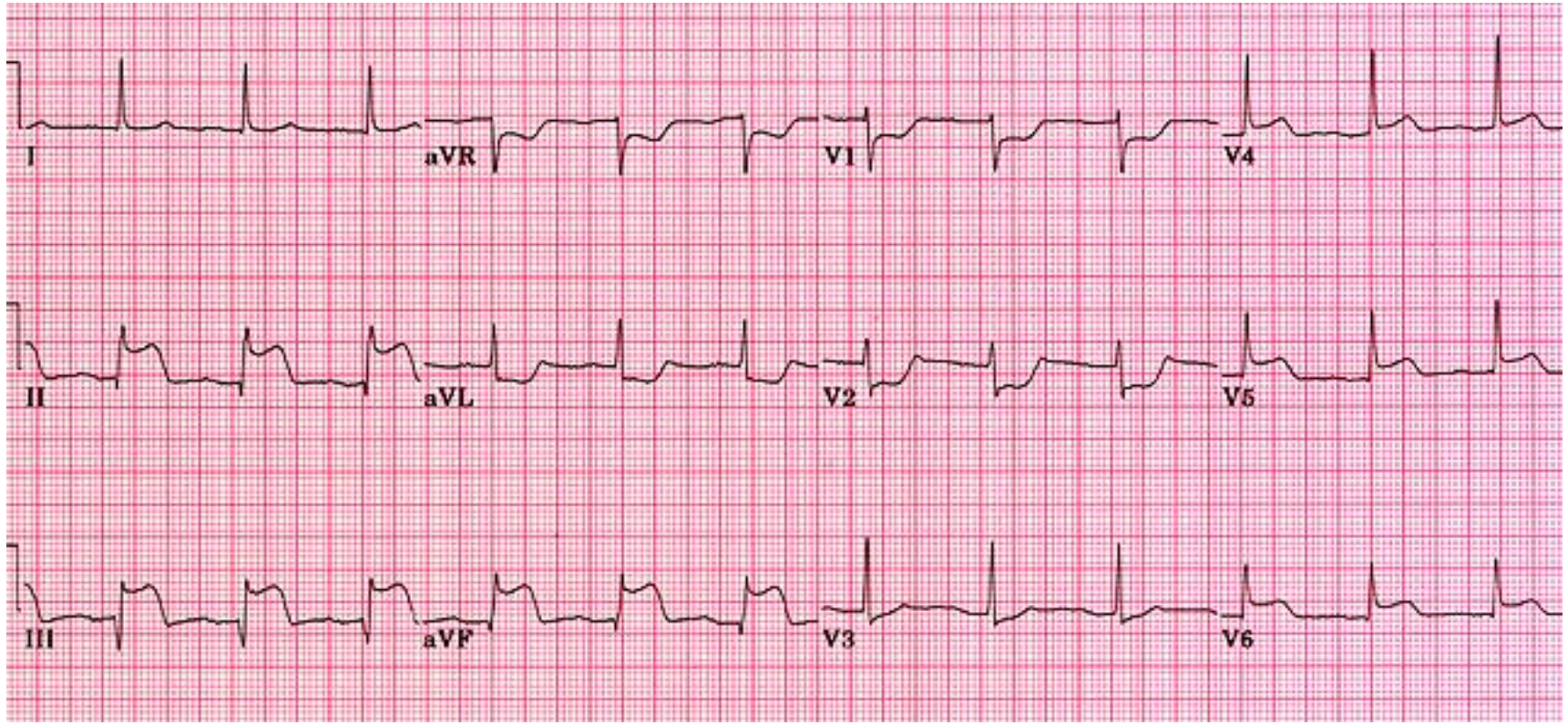
Old MI



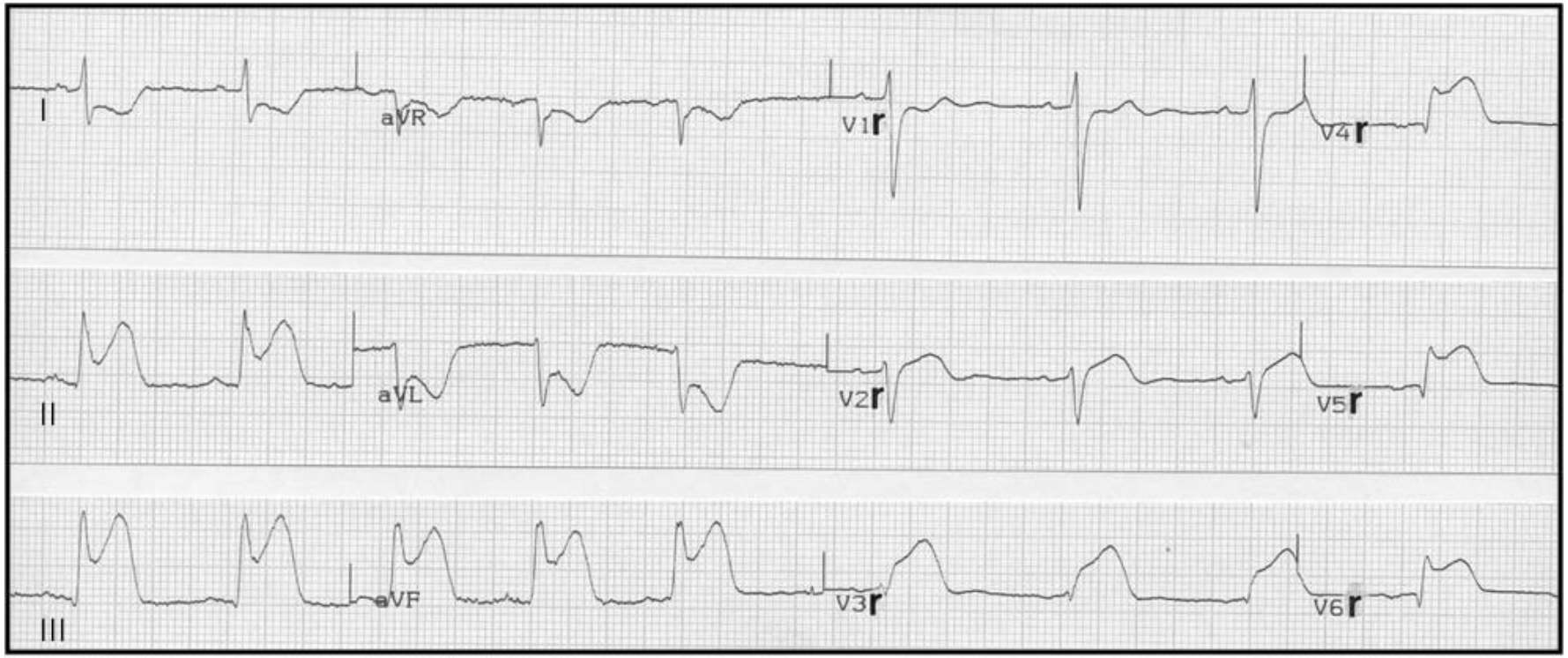
Anterior MI


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25mm/s 10mm/mV 150Hz 005C 12SL 250 CID: 1
EID:766 EDT: 14:50 12-SEP-2005 ORDER:

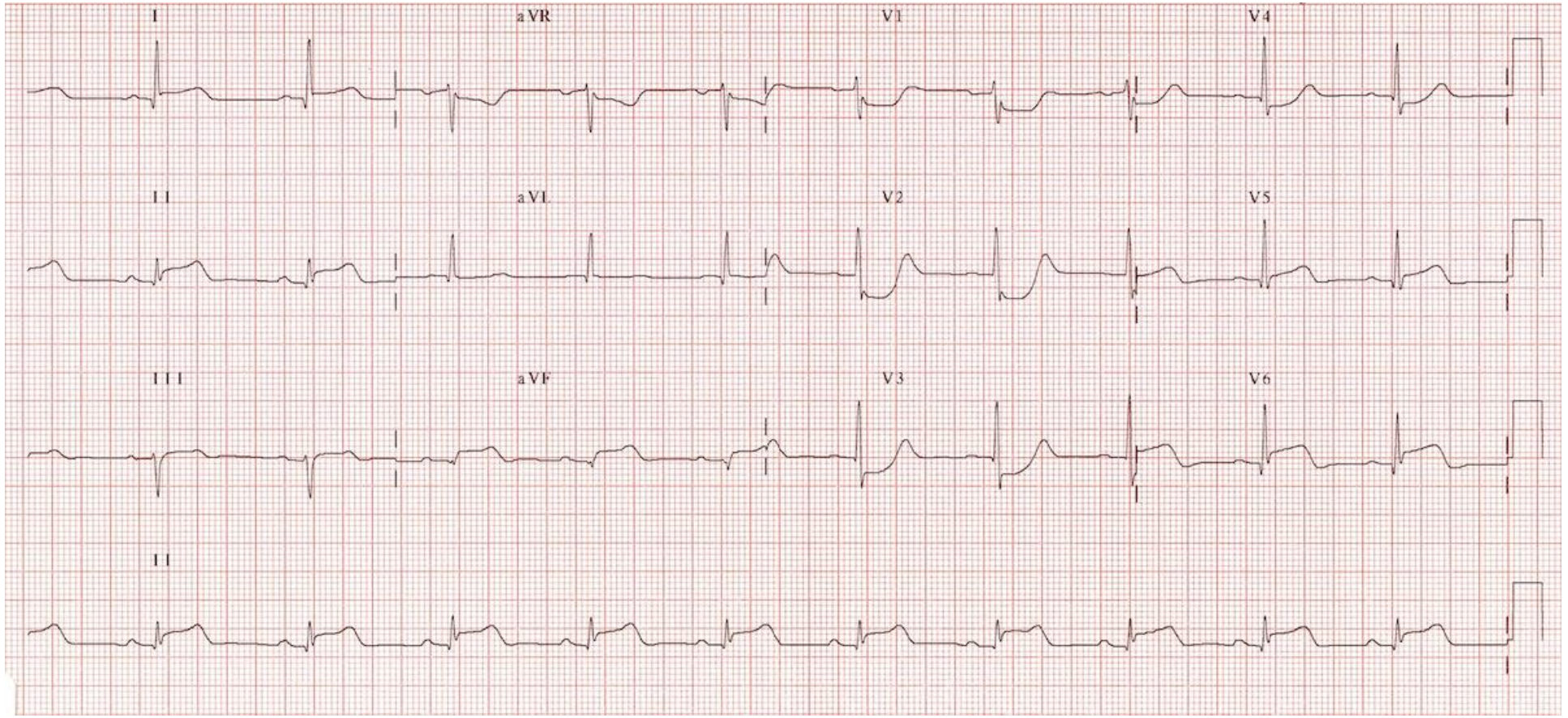
Inferior MI



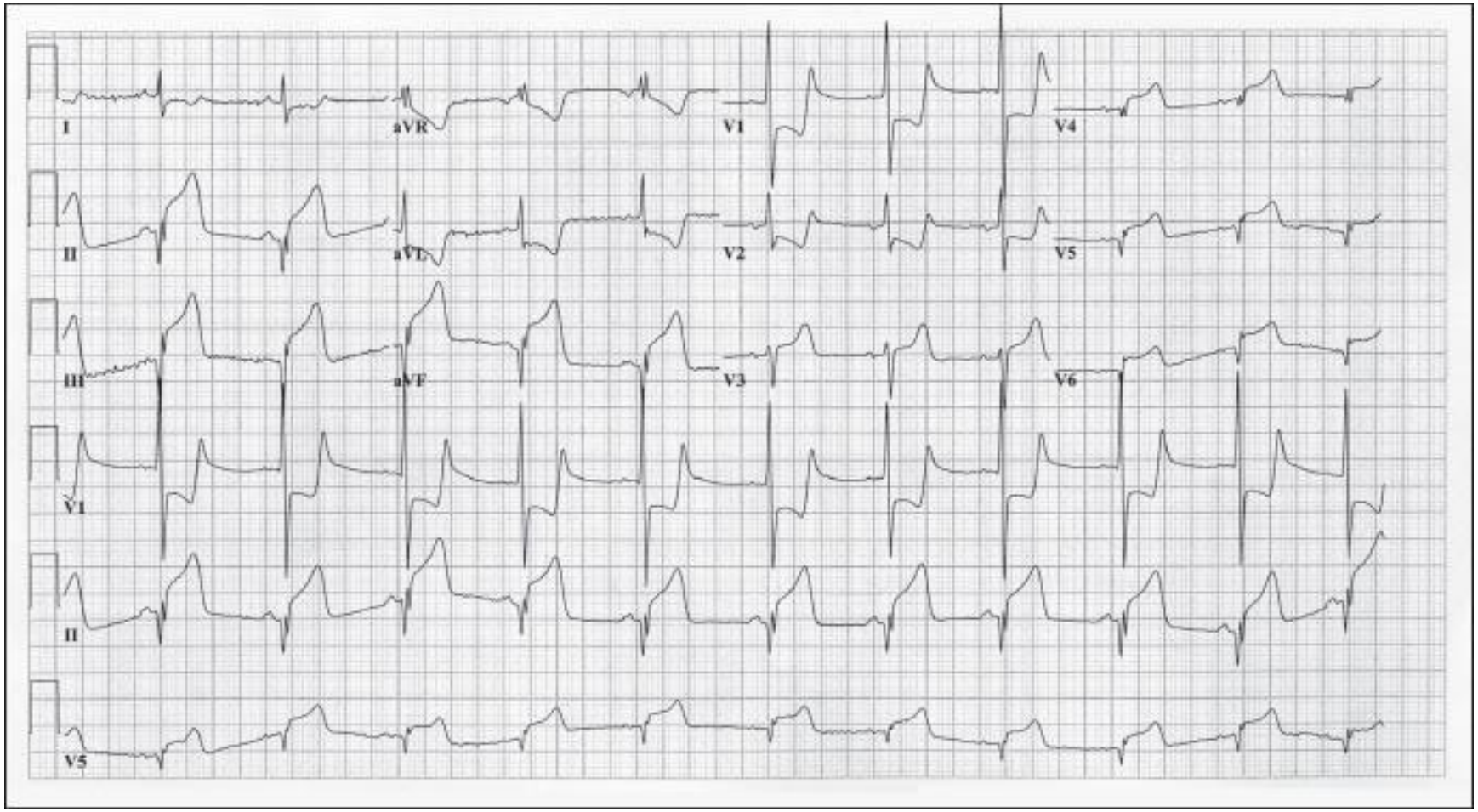
Inf MI



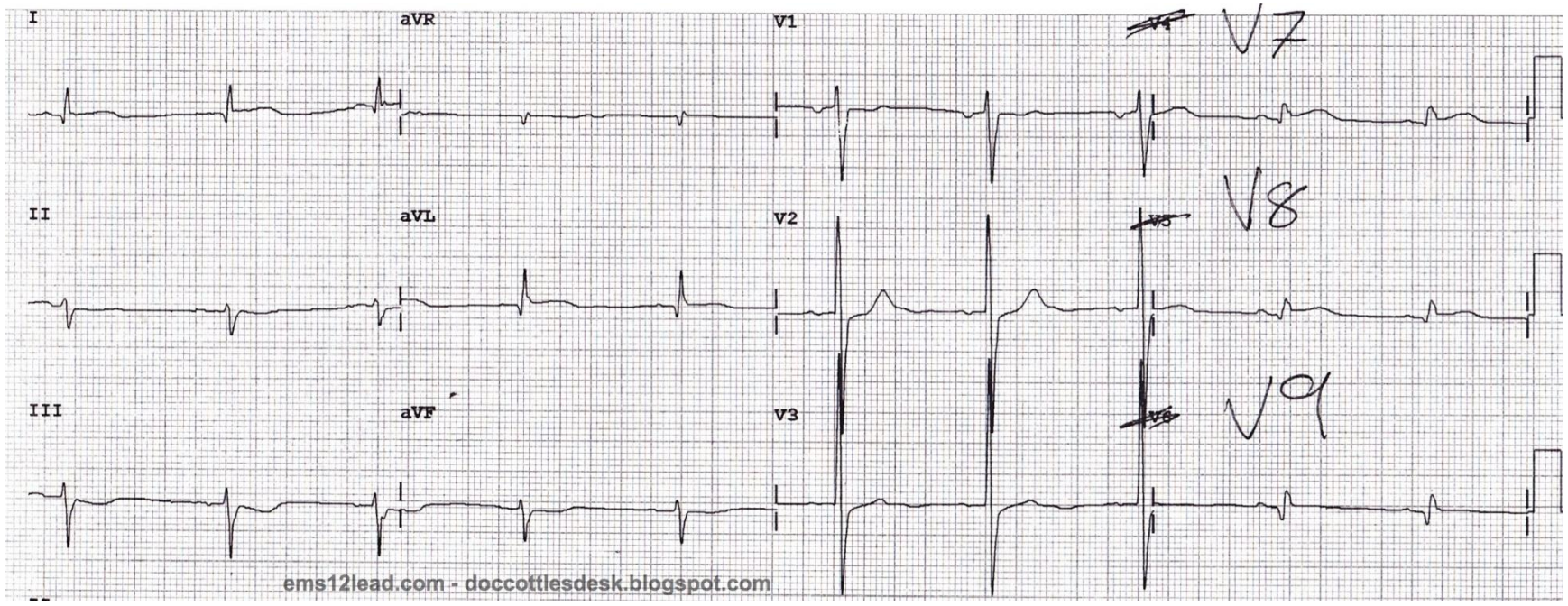
Inferopost MI

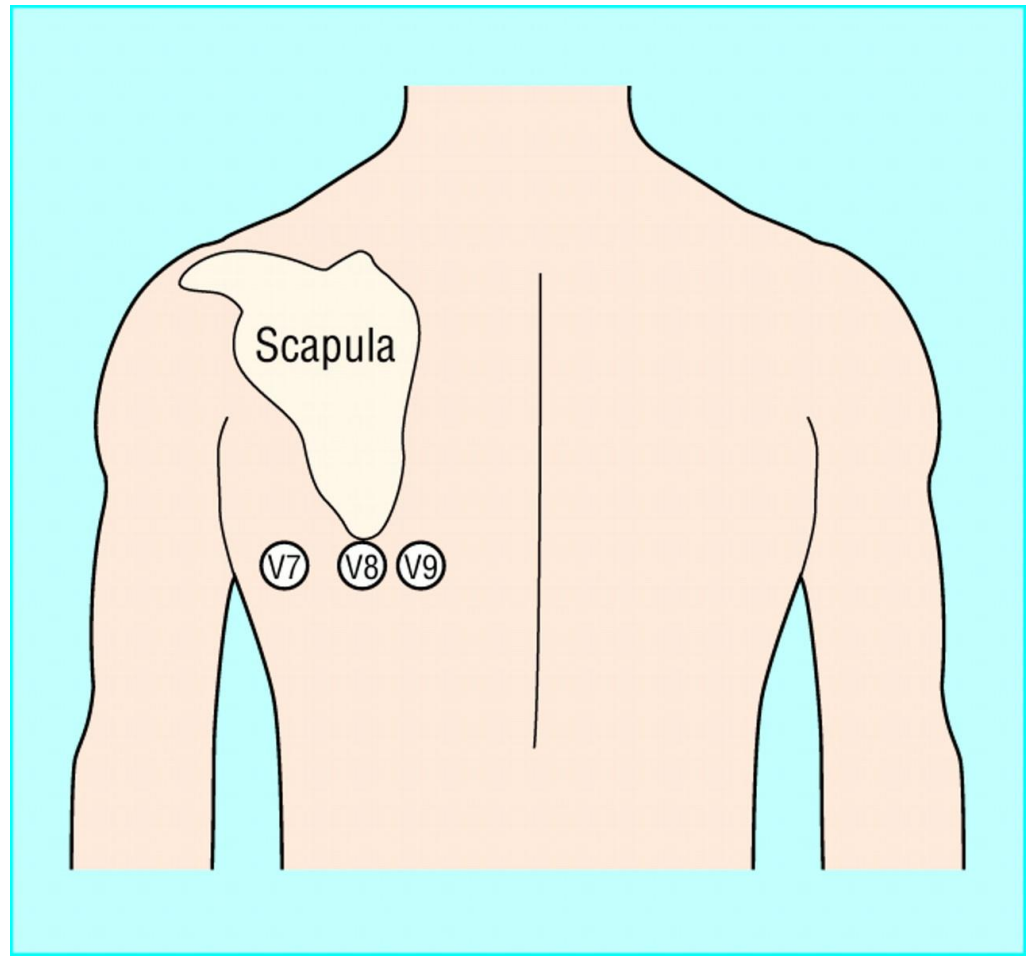


Inferopost MI

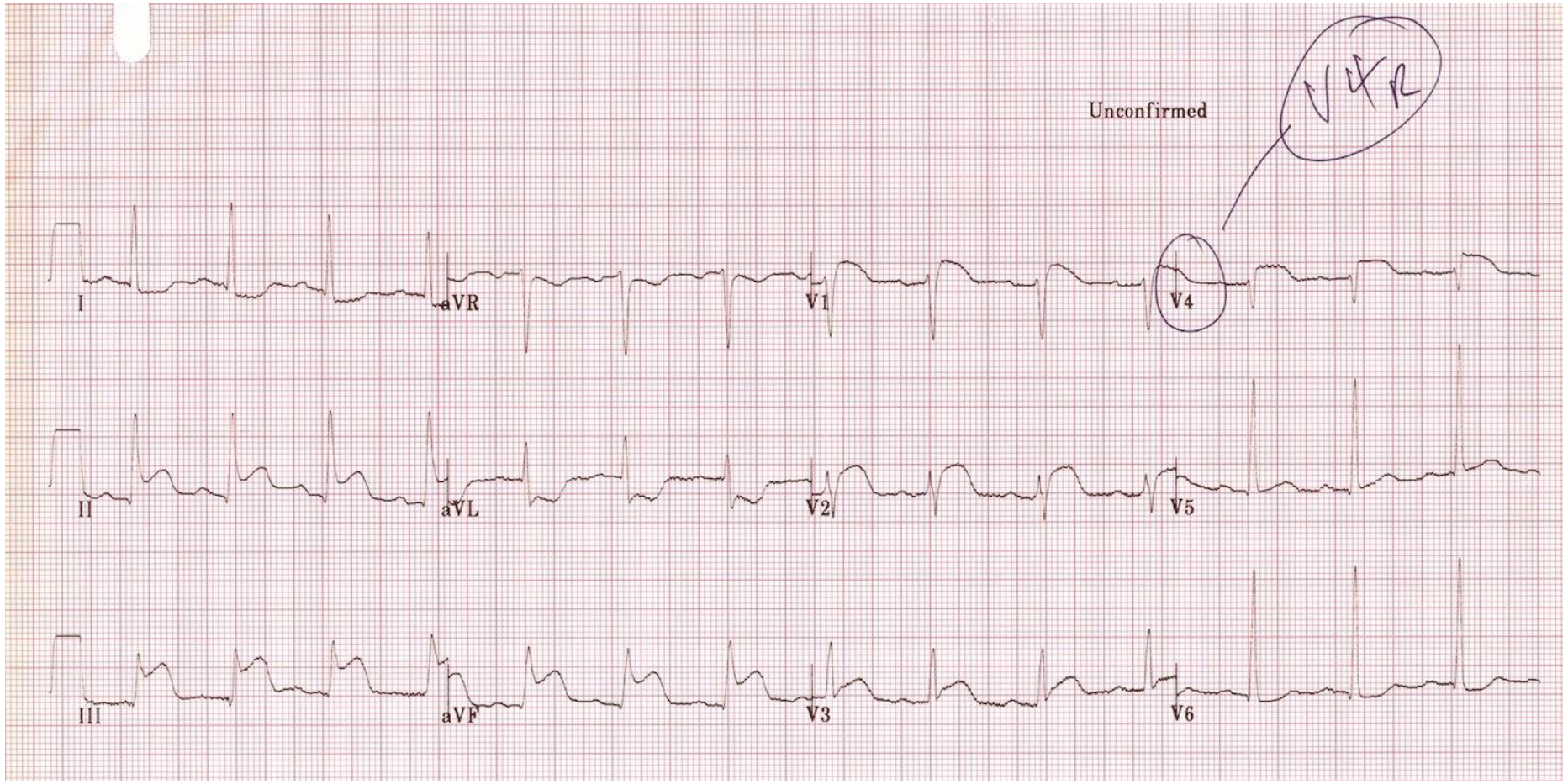


Post lead

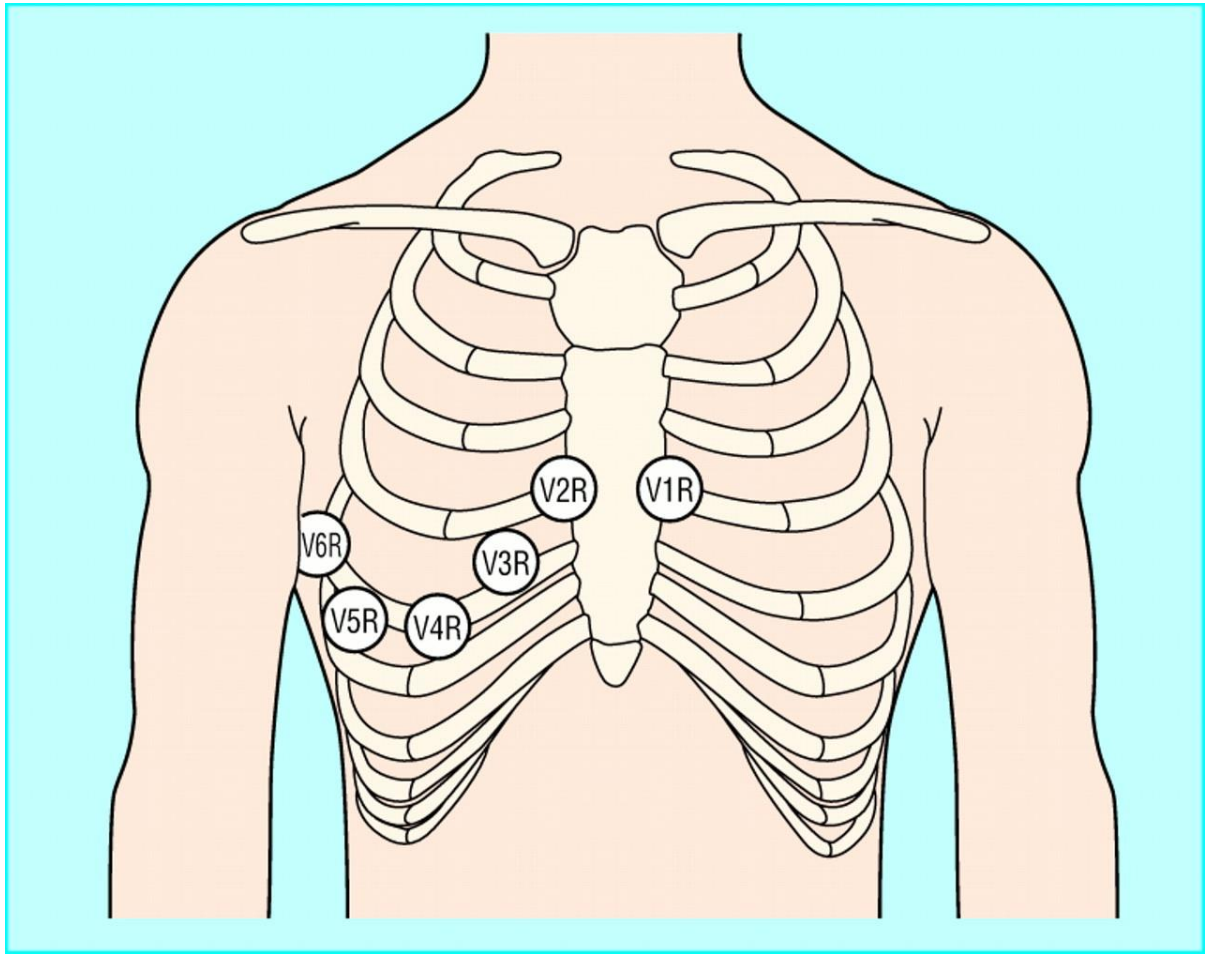

I
aVR
V1
V7
II
aVL
V2
V8
III
aVF
V3
V9
ems12lead.com - doccottlesdesk.blogspot.com


Scapula
V7
V8
V9

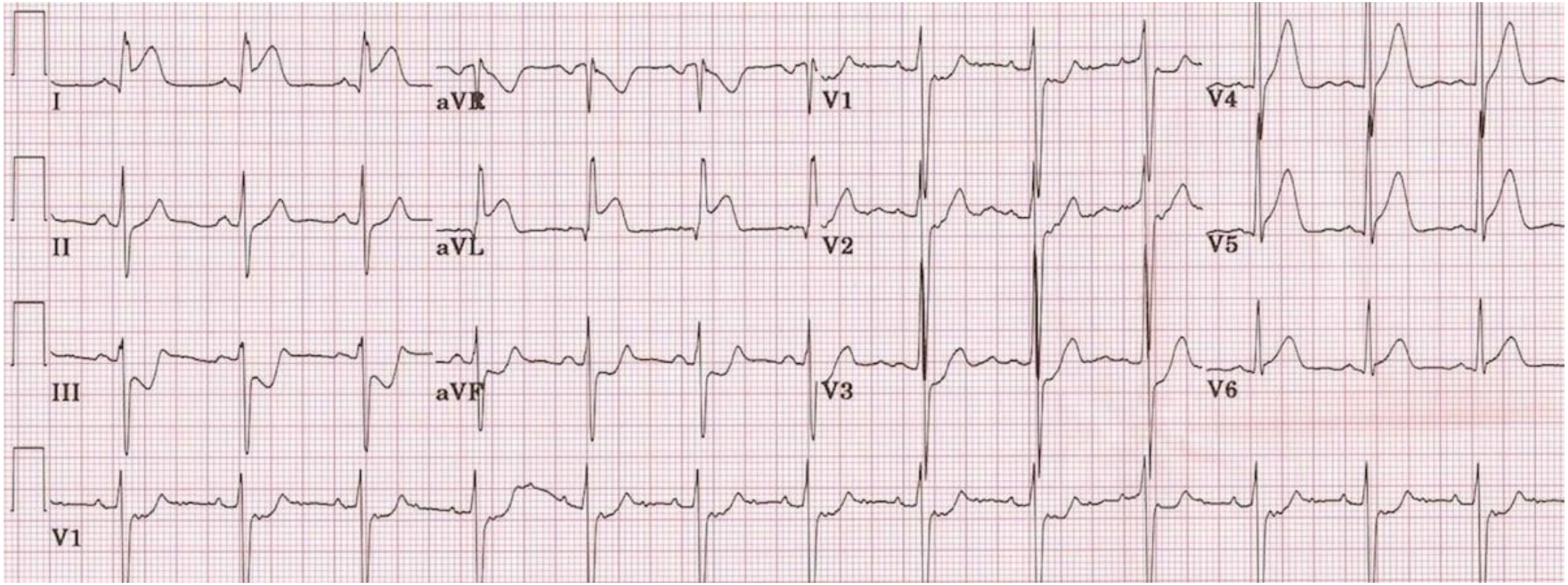
Infero RV MI



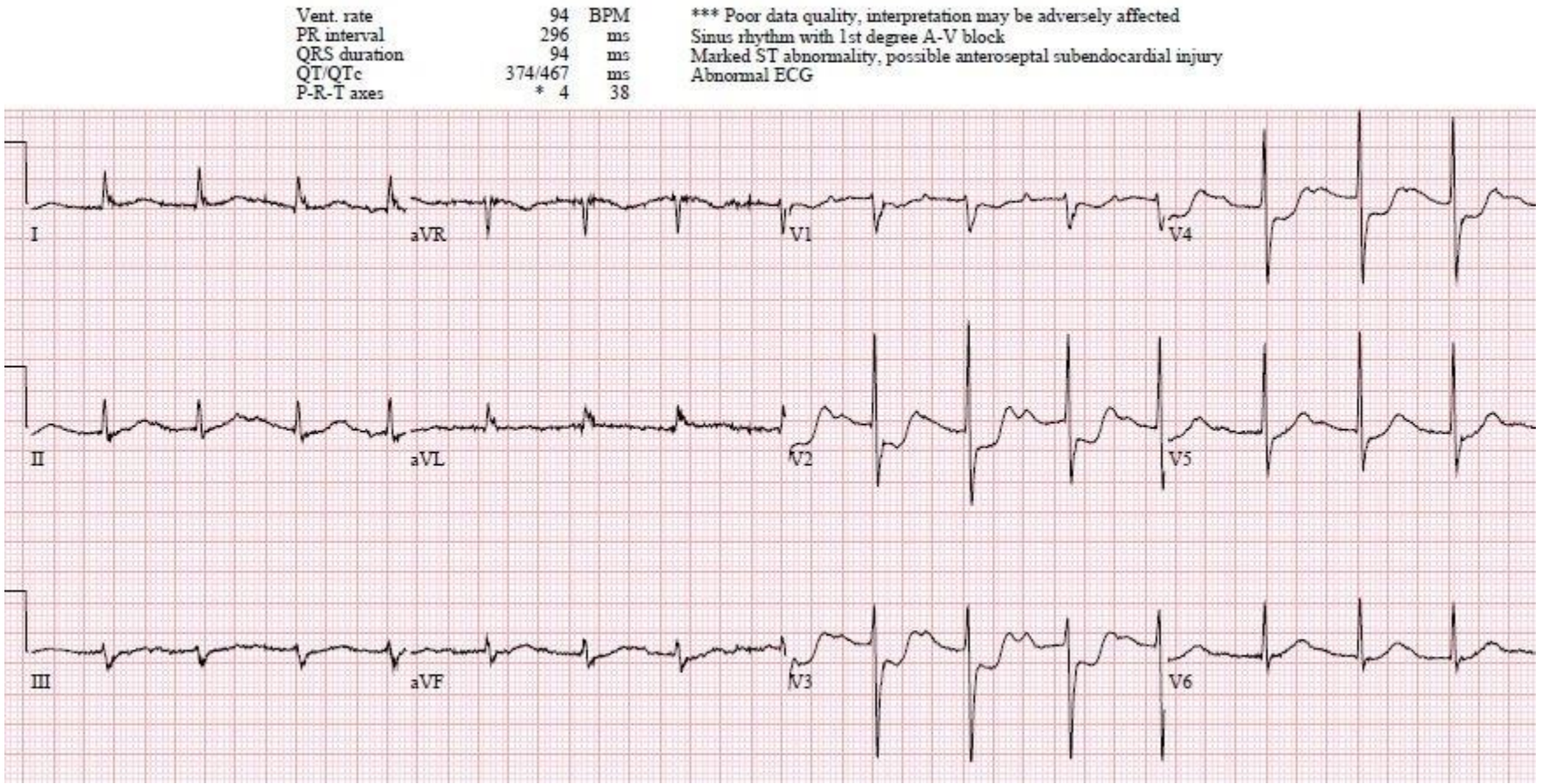
Rt lead



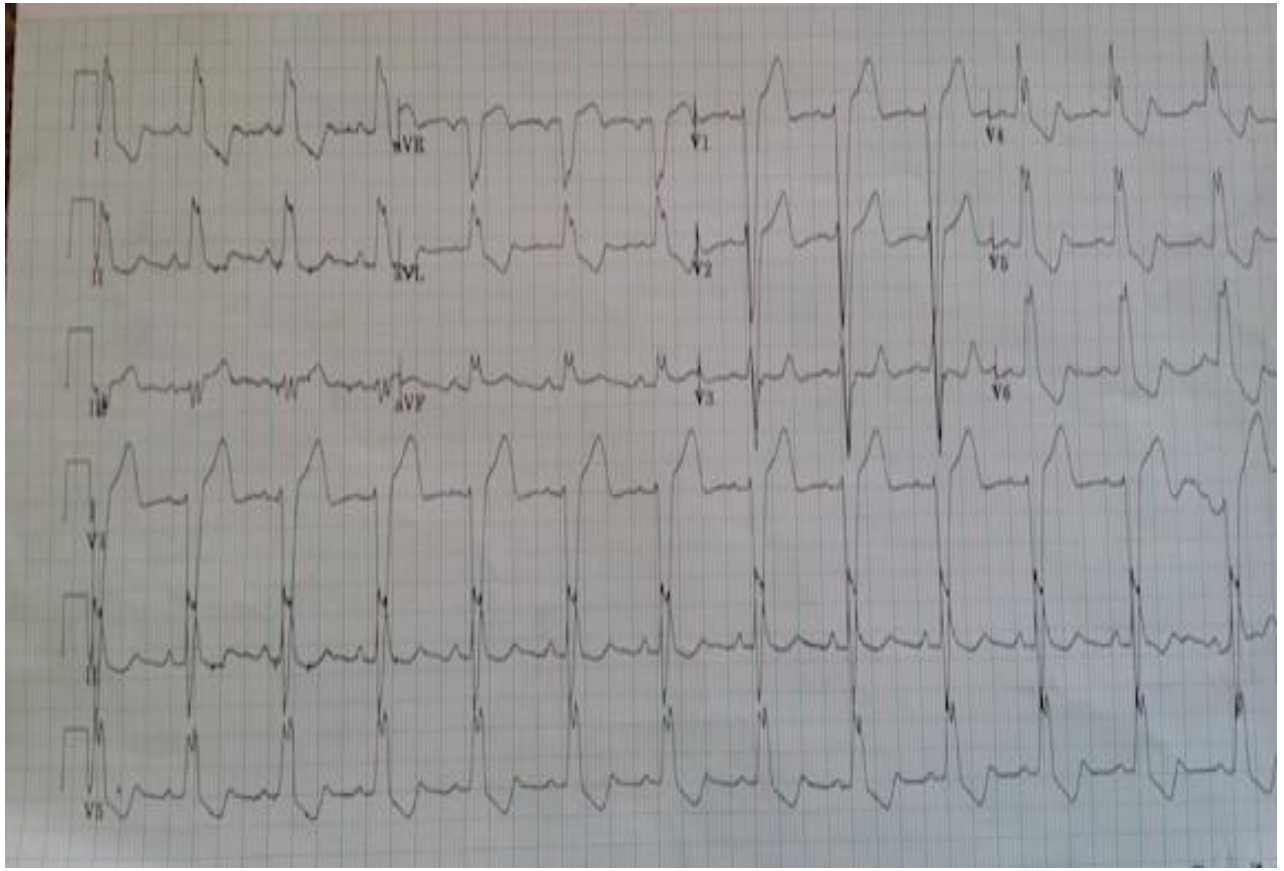
Lateral MI

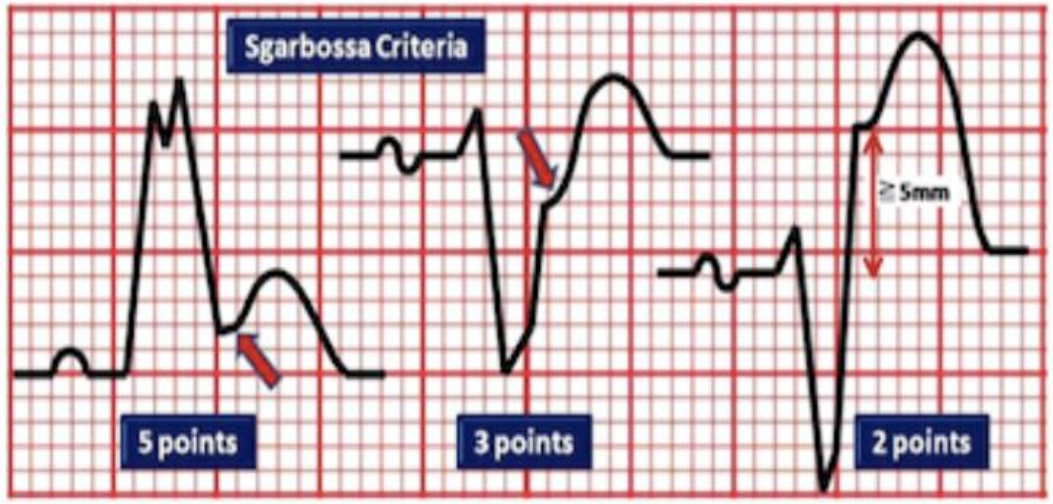


Isolated post MI

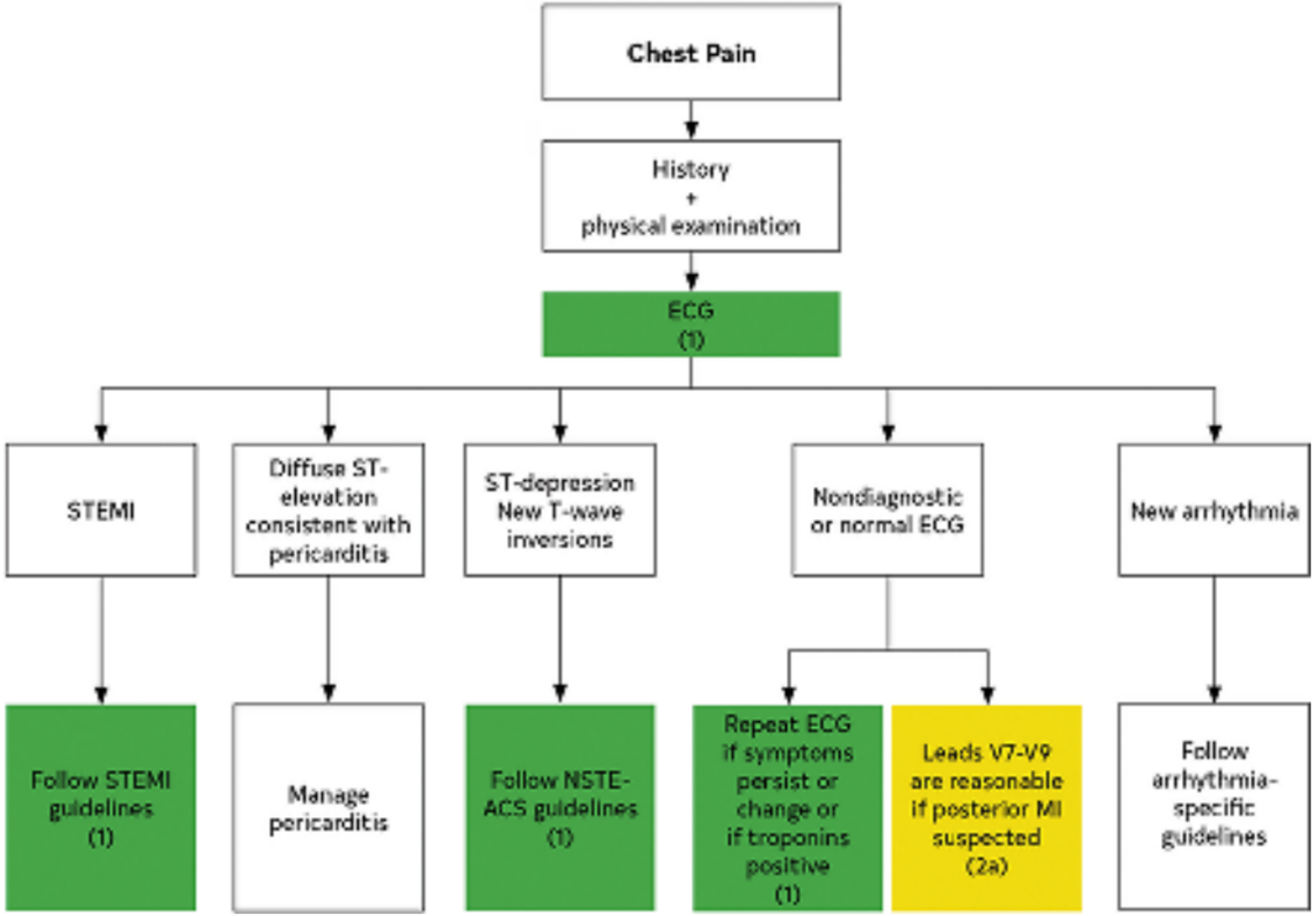


LBBB or pace maker and ACS

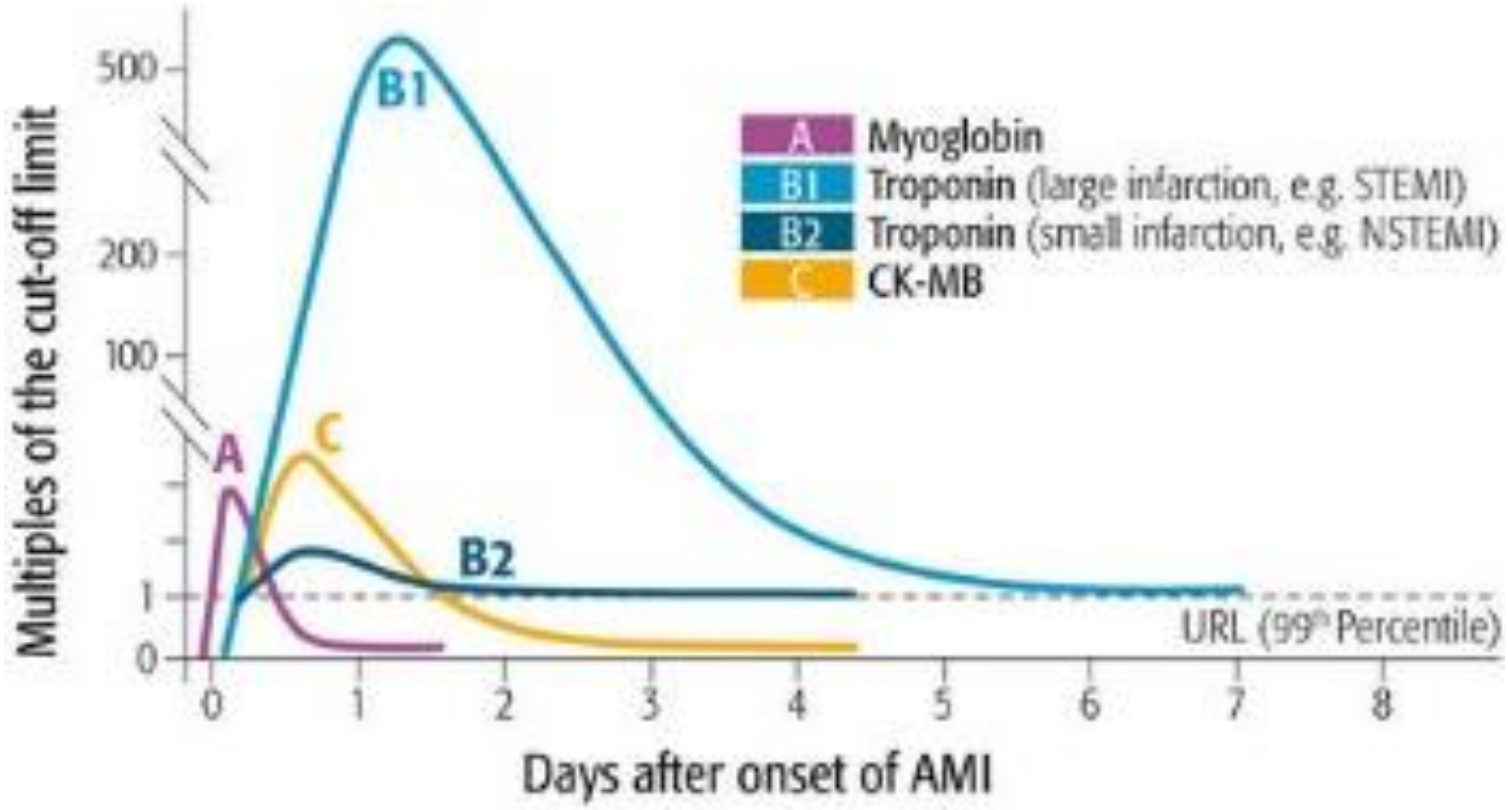




Sgarbossa ECG Criteria for LBBB	
Concordant STE ≥1mm	5 points
STD ≥1mm in V1 – V3	3 points
Discordant STE ≥5mm	2 points


Chest Pain
History
+
physical examination
ECG
(1)
STEMI
Diffusa ST-elevation consistent with pericarditis
ST-depression New T-wave inversions
Nondiagnostic or normal ECG
New arrhythmia
Follow STEMI guidelines (1)
Manage pericarditis
Follow NSTE-ACS guidelines (1)
Repeat ECG if symptoms persist or change or if troponins positive (1)
Leads V7-V9 are reasonable if posterior MI suspected (2a)
Follow arrhythmia-specific guidelines

Serum cardiac biomarkers



Causes of Elevated Plasma cTn Other Than ACS

Cardiac Causes

- Cardiac contusion resulting from trauma
- Cardiac surgery
- Cardioversion
- Endomyocardial biopsy
- Acute and chronic heart failure
- Aortic dissection
- Aortic valve disease
- Hypertrophic cardiomyopathy
- Tachyarrhythmia
- Bradyarrhythmia, heart block
- Apical ballooning syndrome
- Post–PCI
- Rhabdomyolysis with myocyte necrosis
- Myocarditis or endocarditis/pericarditis

Noncardiac Causes

- Pulmonary embolism
- Severe pulmonary hypertension
- Renal failure
- Stroke, SAH
- Infiltrative diseases, eg, amyloidosis
- Cardiotoxic drugs
- Critical illness
- Sepsis
- Extensive burns
- Extreme exertion

Evaluation of patients with chest pain at low or intermediate risk for ACS

HEART

HEART score for chest pain patients

History (Anamnesis)	Highly suspicious	2	
	Moderately suspicious	1	
	Slightly suspicious	0	
ECG	Significant ST-deviation	2	
	Non-specific repolarisation disturbance / LBBB / PM	1	
	Normal	0	
Age	≥ 65 years	2	
	45 – 65 years	1	
	≤ 45 years	0	
Risk factors	≥ 3 risk factors *or* history of atherosclerotic disease	2	
	1 or 2 risk factors	1	
	No risk factors known	0	
Troponin	≥ 3x normal limit	2	
	1-3x normal limit	1	
	≤ normal limit	0	
		Total	

Risk factors for atherosclerotic disease:

Hypercholesterolemia	Cigarette smoking
Hypertension	Positive family history
Diabetes Mellitus	Obesity (BMI>30)

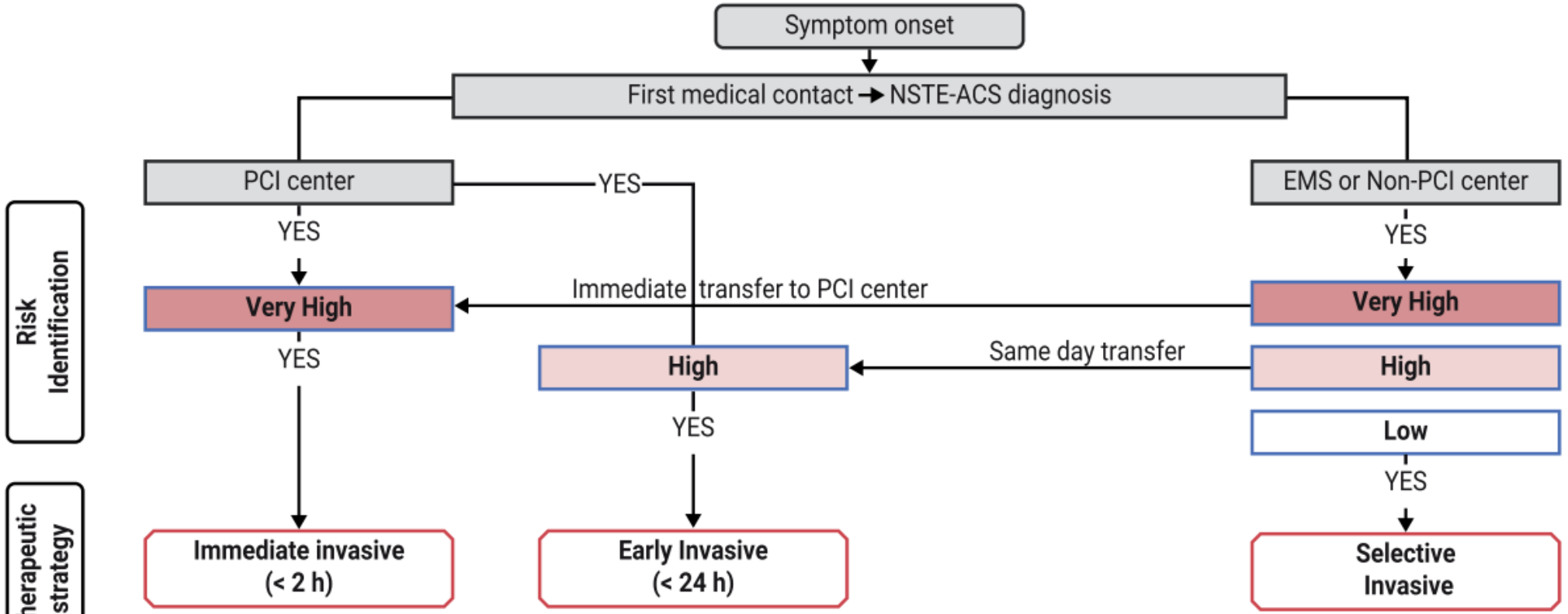
If the score was 0 and obvious non ischemic cause of chest pain

- Are the patients symptoms best explained by a non cardiac diagonosis no further evaluation for ACS is needed

If the score was 1 or was 0 without obvious cause of chest pain

- obtain 2 nd troponin 3 hours after the 1 st troponin
- If second troponin was above the upper reference -> ACS RX
- If not , recalculate heart pathway score if more than 3 obtain non invasive evaluation for ischemia
- If less than 3 if symptoms have resolved discharge without cardiac testing and evaluate other cause

Management of patient with NSTEMI


Symptom onset
First medical contact → NSTE-ACS diagnosis
PCI center
EMS or Non-PCI center
YES
YES
YES
Immediate transfer to PCI center
Same day transfer
Very High
High
Low
Very High
High
Low
YES
YES
YES
Immediate invasive (< 2 h)
Early Invasive (< 24 h)
Selective Invasive
Risk Identification
Therapeutic strategy
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

Management of patient with STEMI

Reperfusion Strategies for STEMI

?

Pharmacologic

Widely available
Quickly administered
Less effective
Bleeding risk

PCI

Limited availability
Treatment delay
More effective
Bleeding risk lower

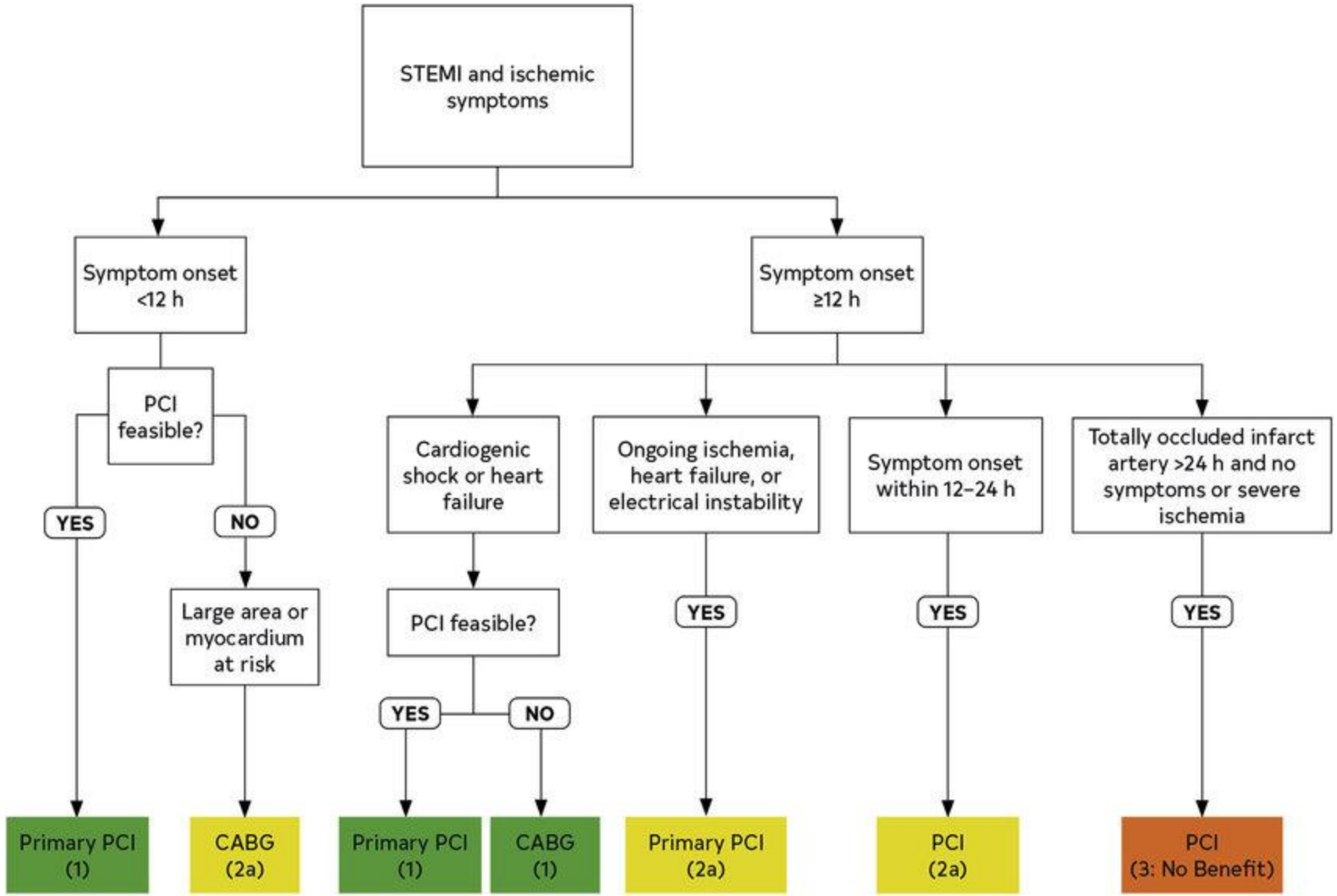
Reperfusion Goals

Door to needle → <30 MIN

Door to balloon → <90 MIN

SYMPTOM ONSET – TO-REPERFUSION → <120 MIN

INCREASING LOSS OF MYOCYTES


STEMI and ischemic symptoms
Symptom onset <12 h
Symptom onset ≥12 h
PCI feasible?
YES
NO
Large area or myocardium at risk
Primary PCI (1)
CABG (2a)
Cardiogenic shock or heart failure
Ongoing ischemia, heart failure, or electrical instability
Symptom onset within 12–24 h
Totally occluded infarct artery >24 h and no symptoms or severe ischemia
PCI feasible?
YES
NO
YES
YES
YES
Primary PCI (1)
CABG (1)
Primary PCI (2a)
PCI (2a)
PCI (3: No Benefit)