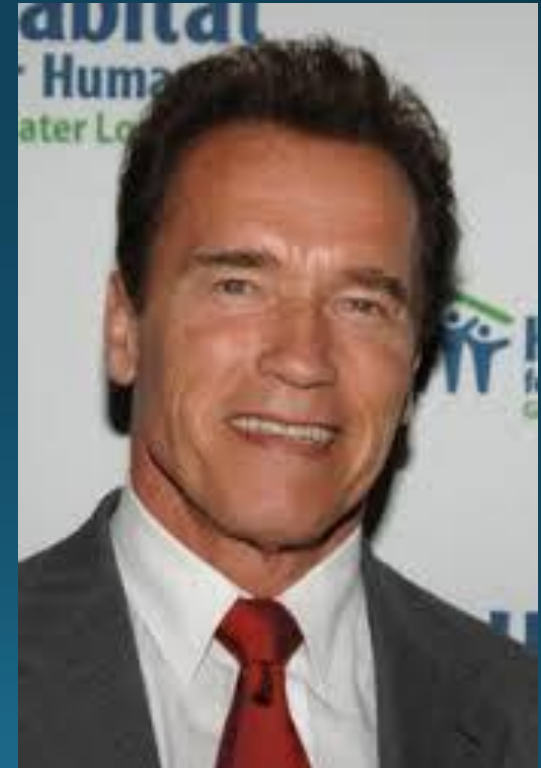
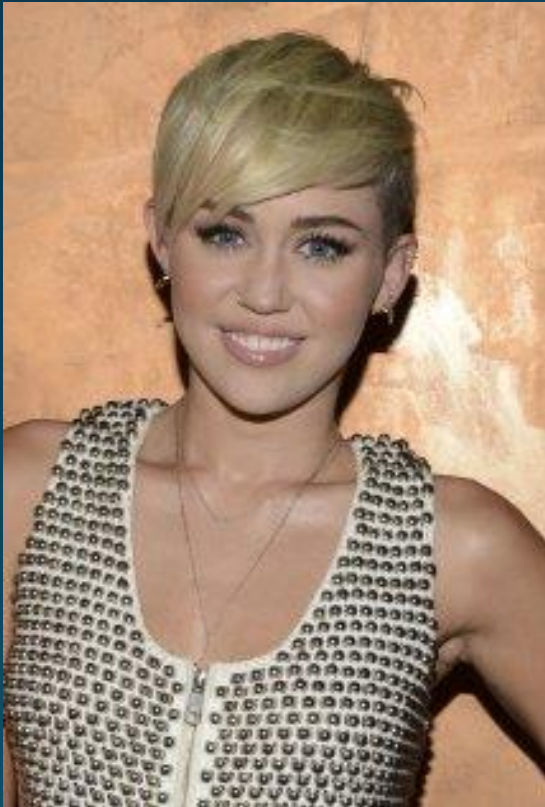


Dr Will Watson

Troponin-itis

Featuring.....

- Celebrity troponin differentials!



Chest pain

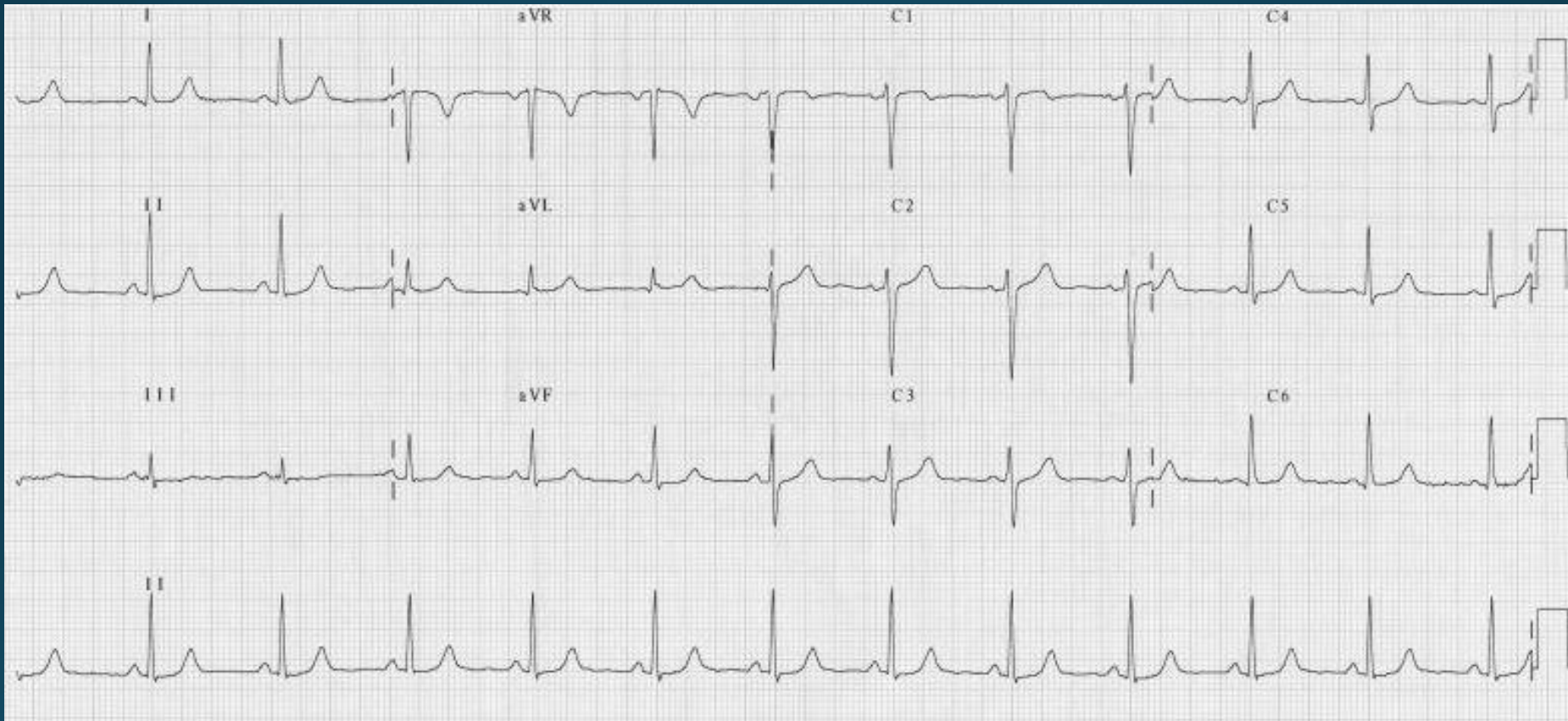
- It's 5pm on a Friday and Casualty is full of chest pain



Case 1

- 53 year old man
- Dull pain over right chest, came on after a game of tennis
- A little clammy and sweaty at the time
- PMHx Hypertension
- O/E HS I+II+o, chest clear, abdo SNT

Case 1



- Trop 6 (3 hours)
- D-dimer 0.22 (negative)

Case 1 options

- Transfer to Papworth for urgent PPCI
- Treat with aspirin, clopidogrel and fondaparinux, admit to monitored bed
- Admit for observation and 6-hour troponin, do not start treatment yet
- Discharge home with reassurance
- I'd like more information



Case 1

- Admitted to medical assessment unit for 6-hour troponin
- Repeat trop 6 at 3 hours
- Discharged home with outpatient cardiology

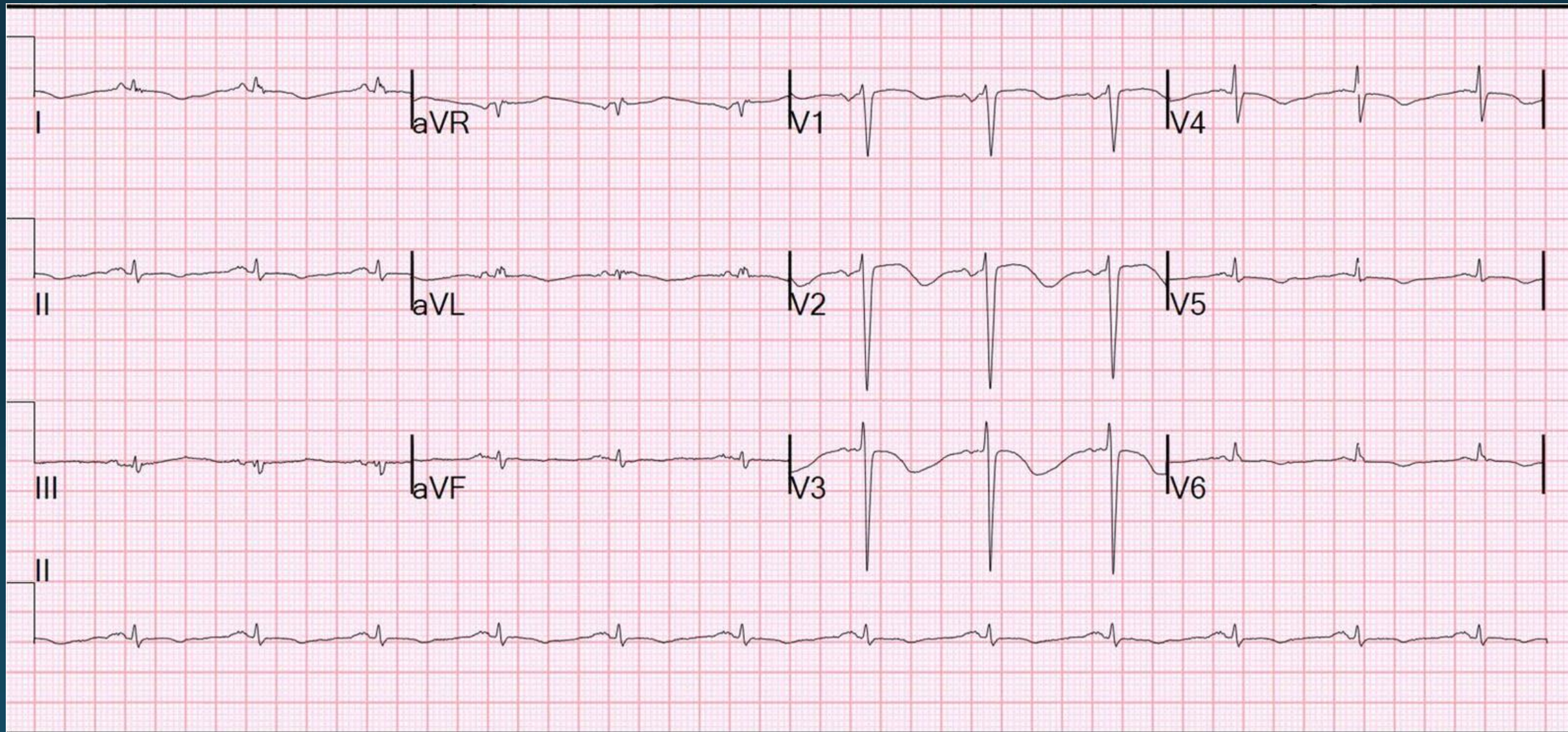
Case 2

- 45 year old woman
- Substernal chest pain following an argument with her husband
- Accompanied by sweating and shortness of breath.

- No PMHx of note. Not on regular medications.

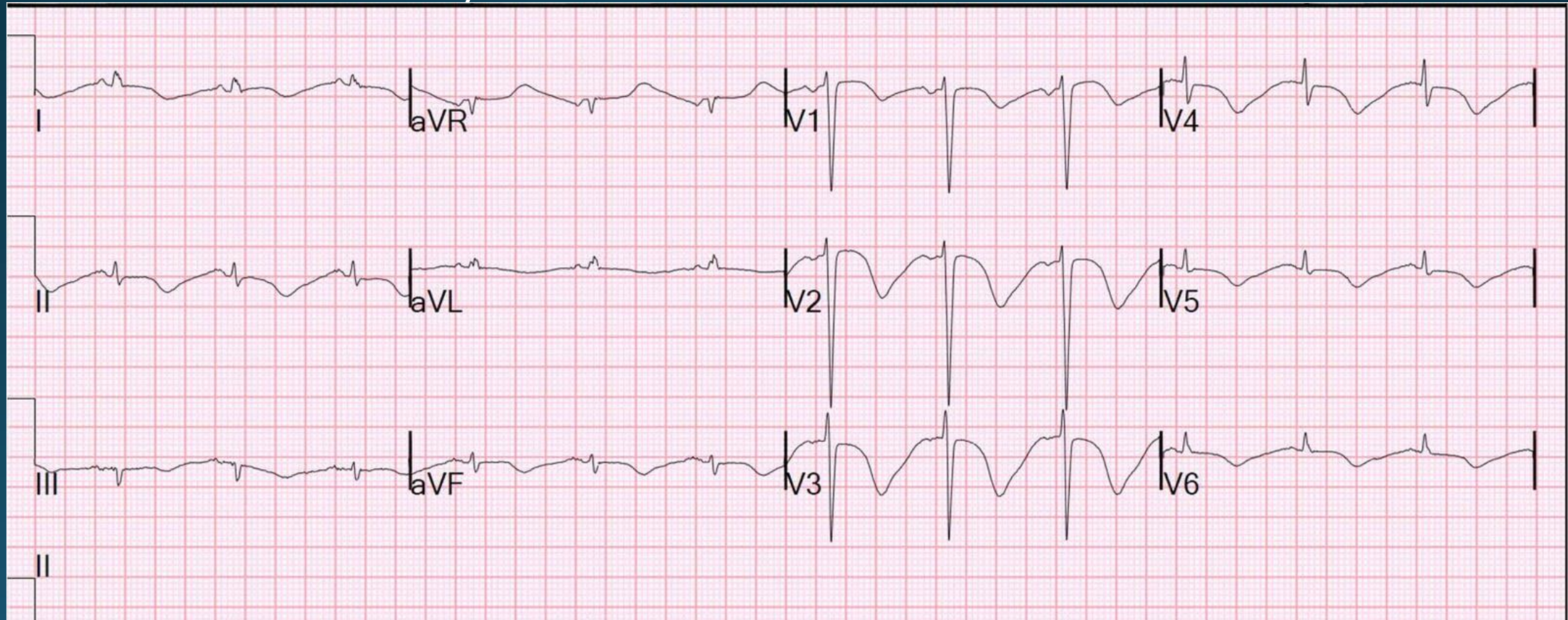
- O/E HS 1 + 2 + 0. Scanty bibasal crepitations.
- BP 110/60, HR 80

Case 2

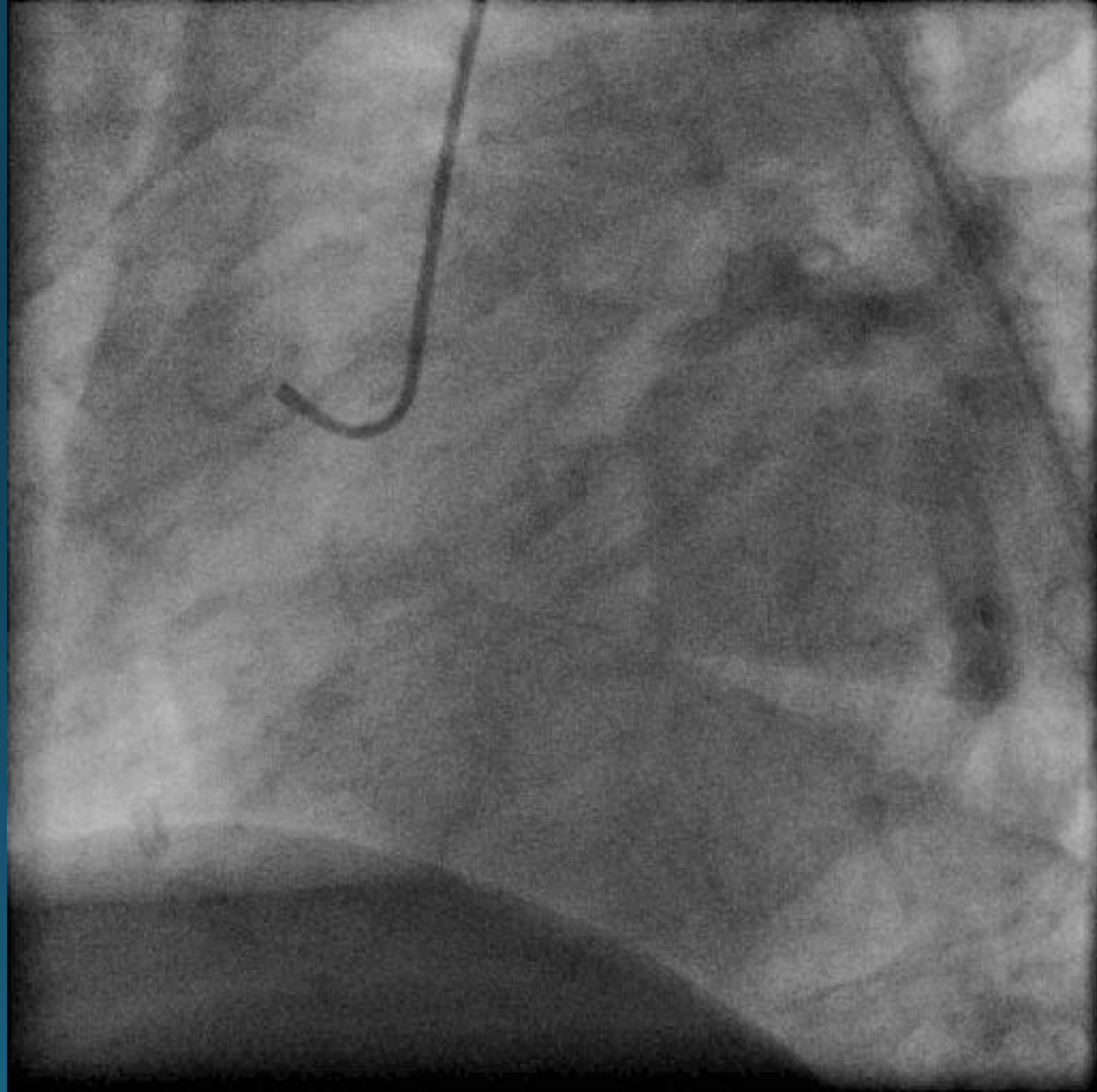


Case 2

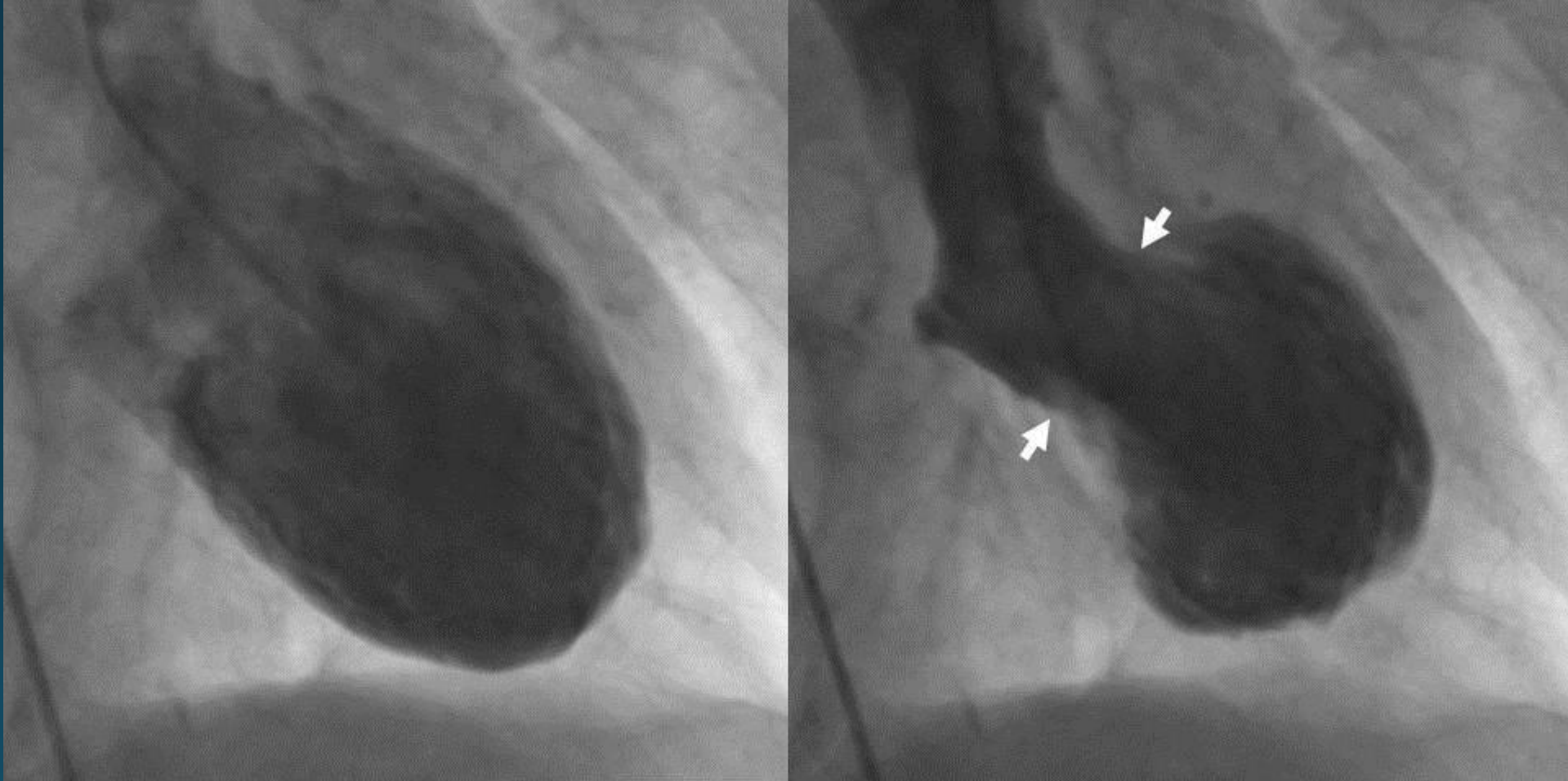
- Troponin elevates 103 to 212
- ECG recorded next day:



Coronary Angiography



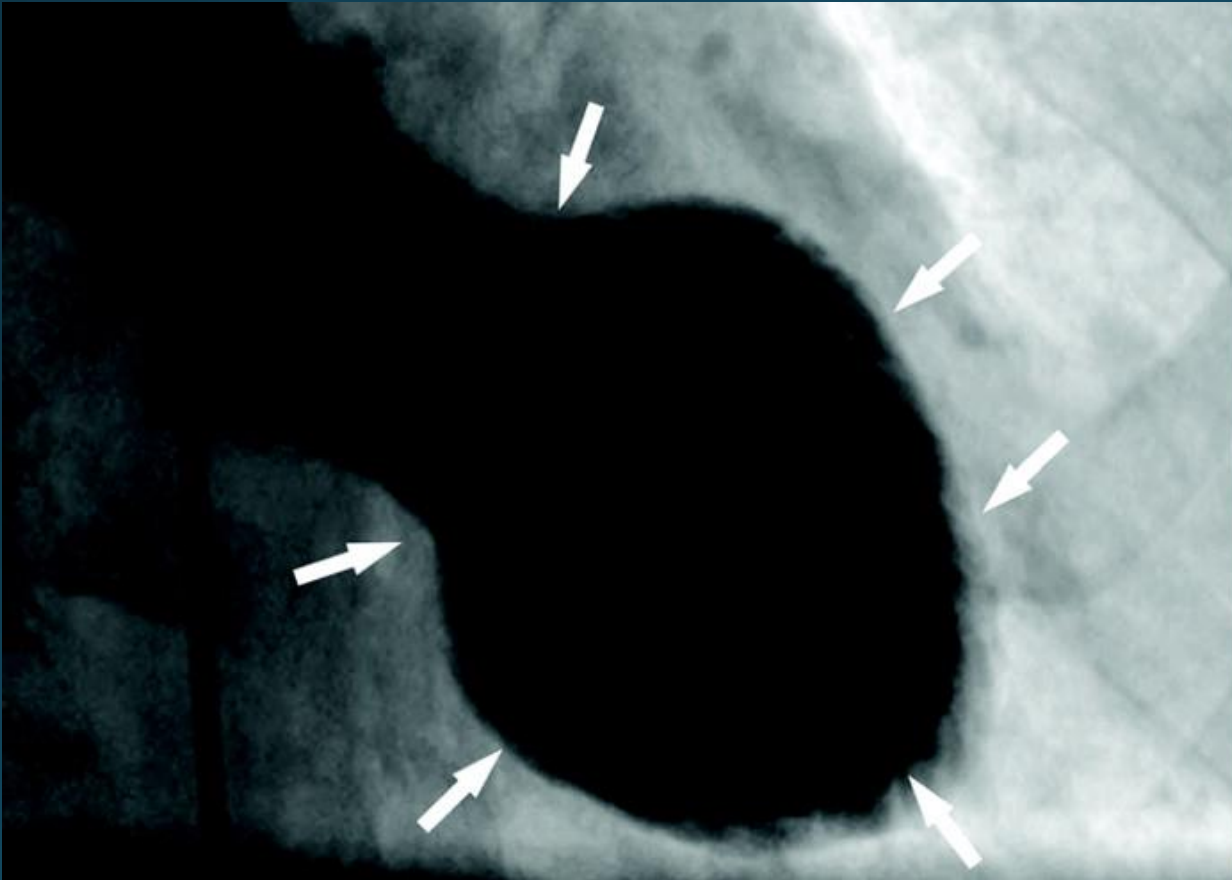
Coronary Angiography: LV-gram



Takotsubo Cardiomyopathy

- Stress cardiomyopathy aka Apical Ballooning syndrome
- Brought on by catecholamine excess
- Presentation with cardiac-sounding chest pain, cardiogenic shock
- Variable ECG changes
 - T-wave inversion
 - ST elevation
- Transient disorder, managed supportively

Octopus pot



Octopus Pot



The Troponin Story

The Troponin Story

(applause)

Cardiac Troponin T in Diagnosis of Acute Myocardial Infarction

Johannes Mair,¹ Erika Artner-Dworzak,¹ Peter Lechleitner,² Jörn Smidt,² Ina Wagner,¹ Bernd Puschendorf^{1,3}

Troponin T is a structurally bound protein found in striated muscle cells. We tested concentrations of its cardiac-specific isotype in peripheral venous blood samples serially drawn from 72 patients with confirmed myocardial infarction. Fifty-nine patients received thrombolytic treatment with intravenous streptokinase, urokinase, or recombinant tissue-type plasminogen activator; because of contraindications, the remaining 13 patients did not. Concentrations of troponin T in plasma, measured by an enzyme-linked immunosorbent assay, started increasing within a few hours after the onset of symptoms (median, 4 h; range, 1-10 h). The sensitivity of troponin T for detecting myocardial infarction was 100% from 10 to 120 h after the onset of symptoms; sensitivity on the seventh day after admission was 84%. Concentrations were increased for up to three weeks in some patients with late or high peak values. Successful reperfusion in Q-wave infarction obviously influences the release of troponin T into plasma, with all such cases showing peak values ≤ 26 h (median, 14 h) after the onset of symptoms. Troponin T concentrations in these patients returned to within the reference interval more rapidly than in nonreperfused subjects. In the 13 patients without fibrinolytic therapy, troponin T tended to peak ~ 48 h (median) after the onset of chest pain. Troponin T concentrations in patients for whom thrombolysis was unsuccessful resembled those in patients without fibrinolytic therapy. The specificity of the assay was 96% as tested in samples of 96 emergency-room patients. The reference interval ($<0.5 \mu\text{g/L}$) was established from samples of 100 healthy blood donors. Troponin T measurements are a specific and sensitive method for the early and late diagnosis of acute myocardial infarction and could, therefore, provide a new criterion in laboratory diagnosis of its occurrence.

Additional Keyphrases: myoglobin • creatine kinase • enzyme-linked immunosorbent assay • thrombolytic reperfusion

istic clinical history, electrocardiogram, and increased serum creatine kinase (CK) and aspartate aminotransferase (AST) activities. However, because the sensitivity of chest pain is limited and the specificity of electrocardiographic changes has various degrees, measurement of troponin T is an important role in the diagnosis of myocardial infarction. Measurements of creatine kinase (CK-MB), aspartate aminotransferase, and lactate dehydrogenase (LDH) are established methods for this. Considerable effort has been made in recent years to improve the sensitivity of methods for diagnosing myocardial infarction. Troponin T is an early and sensitive marker of myocardial damage but lacks specificity (5). The use of troponin T improves specificity in diagnosis of myocardial infarction. Isoenzymes are not restricted to the heart and increase in their serum concentrations in noncardiac conditions. Troponin T therefore benefits from the introduction of a specific marker of damage to the heart. The contractile and regulatory proteins of striated muscle provide such a useful diagnostic marker. Troponin T (TnT) is part of the troponin complex, where it binds the troponin I. Although cardiac and skeletal troponin T, the amino acid sequence of which differs (7, 8), neutralizing antisera against cardiac-specific troponin T demonstrate the high specificity and sensitivity of troponin T in diagnosing and monitoring myocardial infarction.

Materials and Methods

Patients

Subjects were divided into two groups: *Group 1 (blood donors)*. We tested 100 healthy blood donors (41 men and 59 women) with a median age of 44 years, with no history of myocardial infarction.

Cardiac Troponin I

A Marker With High Specificity for Cardiac Injury

Jesse E. Adams III, MD; Geza S. Bodor, MD, PhD; Victor G. Dávila-Román, MD; James A. Delmez, MD; Fred S. Apple, PhD; Jack H. Ladenson, PhD; and Allan S. Jaffe, MD

Background. Levels of MBCK can be increased in patients with skeletal muscle injury or renal failure in the absence of myocardial injury, causing diagnostic confusion. This study was designed to determine whether measurement of cardiac troponin I (cTnI), a myocardial regulatory protein with comparable sensitivity to MBCK, has sufficient specificity to clarify the etiology of MBCK elevations in patients with acute or chronic skeletal muscle disease or renal failure.

Methods and Results. Of the patients ($n=215$) studied, 37 had acute skeletal muscle injury, 10 had chronic muscle disease, nine were marathon runners, and 159 were chronic dialysis patients. Patients were evaluated clinically, by ECG, and by two-dimensional echocardiography. Total creatine kinase (normal, <170 IU/L) was determined spectrophotometrically, and cTnI (normal, <3.1 ng/mL) and MBCK (normal, <6.7 ng/mL) were determined with specific monoclonal antibodies. Values above the upper reference limit were considered "elevated." Elevations of total creatine kinase were common, and elevations of MBCK occurred in 59% of patients with acute muscle injury, 78% of patients with chronic muscle disease and marathon runners, and 3.8% of patients with chronic renal failure. Some of the patients were critically ill; five patients were found to have had myocardial infarctions and one had a myocardial contusion. cTnI was elevated only in these patients.

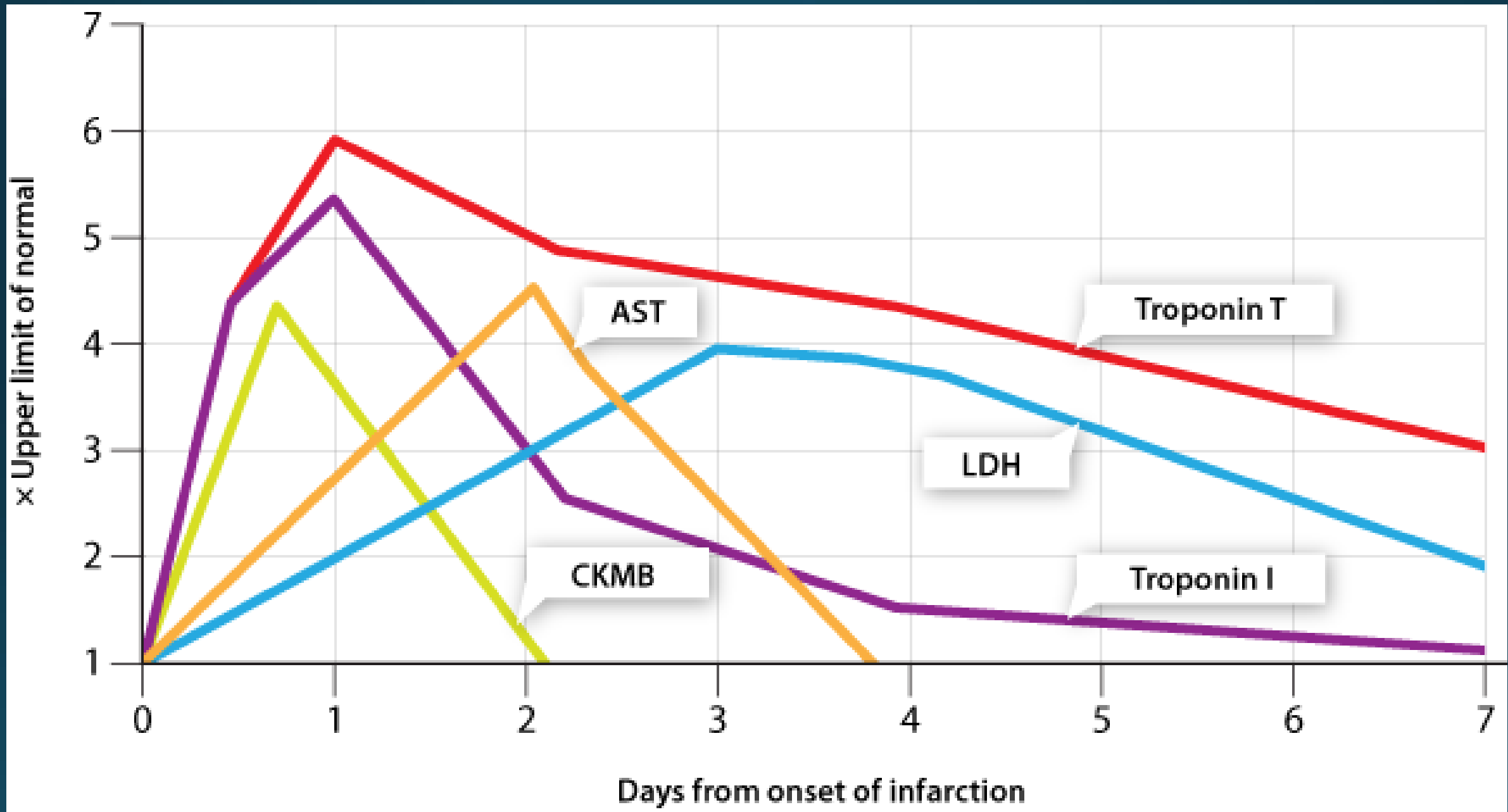
Conclusions. Elevations of cTnI are highly specific for myocardial injury. Use of cTnI should facilitate distinguishing whether elevations of MBCK are due to myocardial or skeletal muscle injury. (*Circulation* 1993;88:101-106)

KEY WORDS • cardiac troponin I • creatine kinase

Patients with elevations of total creatine kinase (CK) caused by skeletal muscle injury often manifest elevations of MBCK, which can cause diagnostic confusion.¹⁻⁴ These patients generally have chronic or severe acute skeletal muscle injury but also may be at risk for myocardial injury either directly as a consequence of the process affecting skeletal muscle or because of an independent cardiac abnormality. Increases in MBCK also occur in 5% of patients with chronic renal failure, probably as a consequence of skeletal myopathy.⁵ Determining whether elevations of MBCK reflect skeletal muscle or myocardial damage is essential for proper patient management but is often difficult. The percentage of MBCK with respect to total CK has poor sensitivity for the detection of myocardial

injury. Furthermore, the percentage of total CK composed of MBCK increases in regenerating skeletal muscle.⁷ Thus, a sensitive and highly specific marker of myocardial injury would be of substantial clinical value in patients with skeletal muscle disease.

Troponin I, C, and T form a complex that regulates the calcium-modulated interaction of actin and myosin in striated muscle. Troponin I from cardiac muscle and slow- and fast-twitch skeletal muscle are products of different genes with unique amino acid sequences.⁸⁻¹⁰ Thus, recently developed monoclonal antibodies to cardiac troponin I (cTnI) have no cross-reactivity with the skeletal muscle forms.¹¹ Furthermore, initial studies suggest that measurement of cTnI has sensitivity comparable to MBCK for the diagnosis of myocardial



2000: redefinition of MI

"Elevation of cTn in blood above the 99th centile of a healthy reference population in conjunction with signs or symptoms of ischaemia"

Troponin I allows for more sensitive diagnosis of acute MI

Elevation in troponin also accurately predicts further risk

- 3.44 x increase in death/MI at 30 days vs unstable angina group

Myocardial infarction redefined—a consensus document of the Joint European Society of Cardiology/American College of Cardiology committee for the redefinition of myocardial infarction. Alpert et al (2000)

2010: High Sensitivity TnI

- Increased sensitivity for detection
- Allows earlier testing in low-risk individuals
- Detects troponin levels in normal individuals

2570 Bandstein *et al.*
Undetectable Troponins and Risk of MI

JACC Vol. 63, No. 23, 2014
June 17, 2014:2569-78

Undetectable High-Sensitivity Cardiac Troponin T Level in the Emergency Department and Risk of Myocardial Infarction

Objectives	This study sought to evaluate if an undetectable (<5 ng/l) high-sensitivity cardiac troponin T (hs-cTnT) level and an electrocardiogram (ECG) without signs of ischemia can rule out myocardial infarction (MI) in the emergency department (ED).
Background	Chest pain is a common symptom often associated with benign conditions, but may be a sign of MI. Because there is no rapid way to rule out MI, many patients are admitted to the hospital.
Methods	All patients who sought medical attention for chest pain and had at least 1 hs-cTnT analyzed during 2 years at the Karolinska University Hospital, Stockholm, Sweden, were included. We calculated the negative predictive values of an undetectable hs-cTnT and ECG without ischemia for MI and death within 30 days.
Results	We included 14,636 patients, of whom 8,907 (61%) had an initial hs-cTnT of <5 ng/l; 21% had 5 to 14 ng/l, and 18% had >14 ng/l. During 30-day follow-up, 39 (0.44%) patients with undetectable hs-cTnT had a MI, of whom 15 (0.17%) had no ischemic ECG changes. The negative predictive value for MI within 30 days in patients with undetectable hs-cTnT and no ischemic ECG changes was 99.8% (95% confidence interval [CI]: 99.7 to 99.9). The negative predictive value for death was 100% (95% CI: 99.9 to 100).
Conclusions	All patients with chest pain who have an initial hs-cTnT level of <5 ng/l and no signs of ischemia on an ECG have a minimal risk of MI or death within 30 days, and can be safely discharged directly from the ED. (J Am Coll Cardiol 2014;63:2569-78) © 2014 by the American College of Cardiology Foundation

Chest pain is the cardinal symptom of myocardial infarction (MI), and it is one of the most common complaints of patients seeking medical attention in the emergency department (ED), accounting for an estimated 15 to 20 million ED visits per year in Europe and the United States (1-3). Although chest pain is often merely a sign of a completely benign condition, it may indicate that the patient is experiencing a life-threatening disease. As much as 2% of patients with MI are inadvertently discharged directly from the ED, which is associated with a doubling of the risk of death (4). Current guidelines therefore recommend that

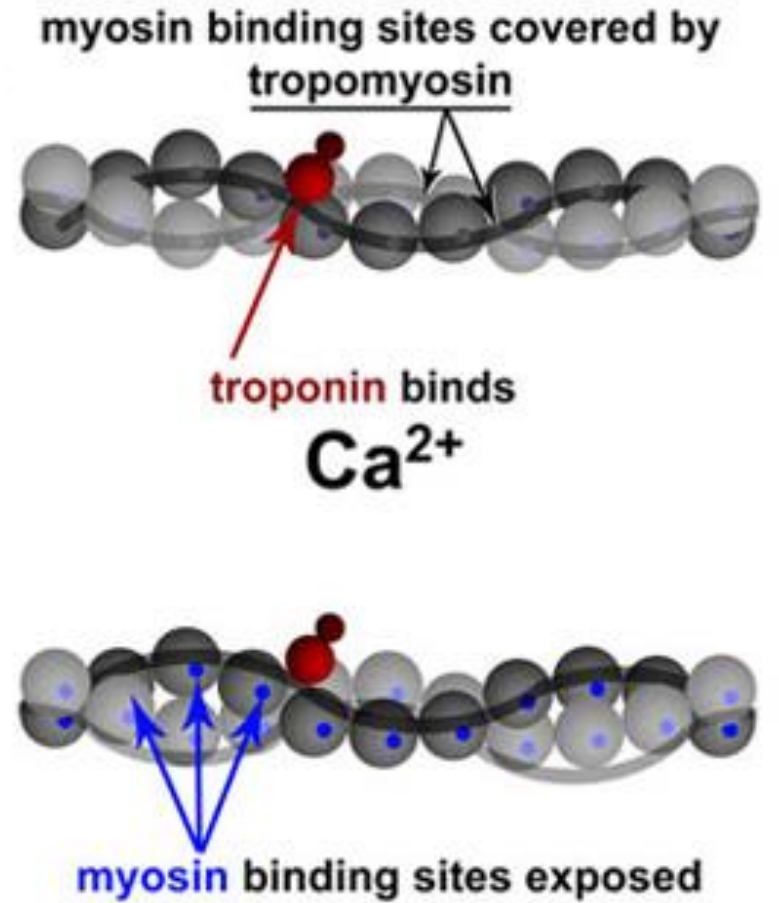
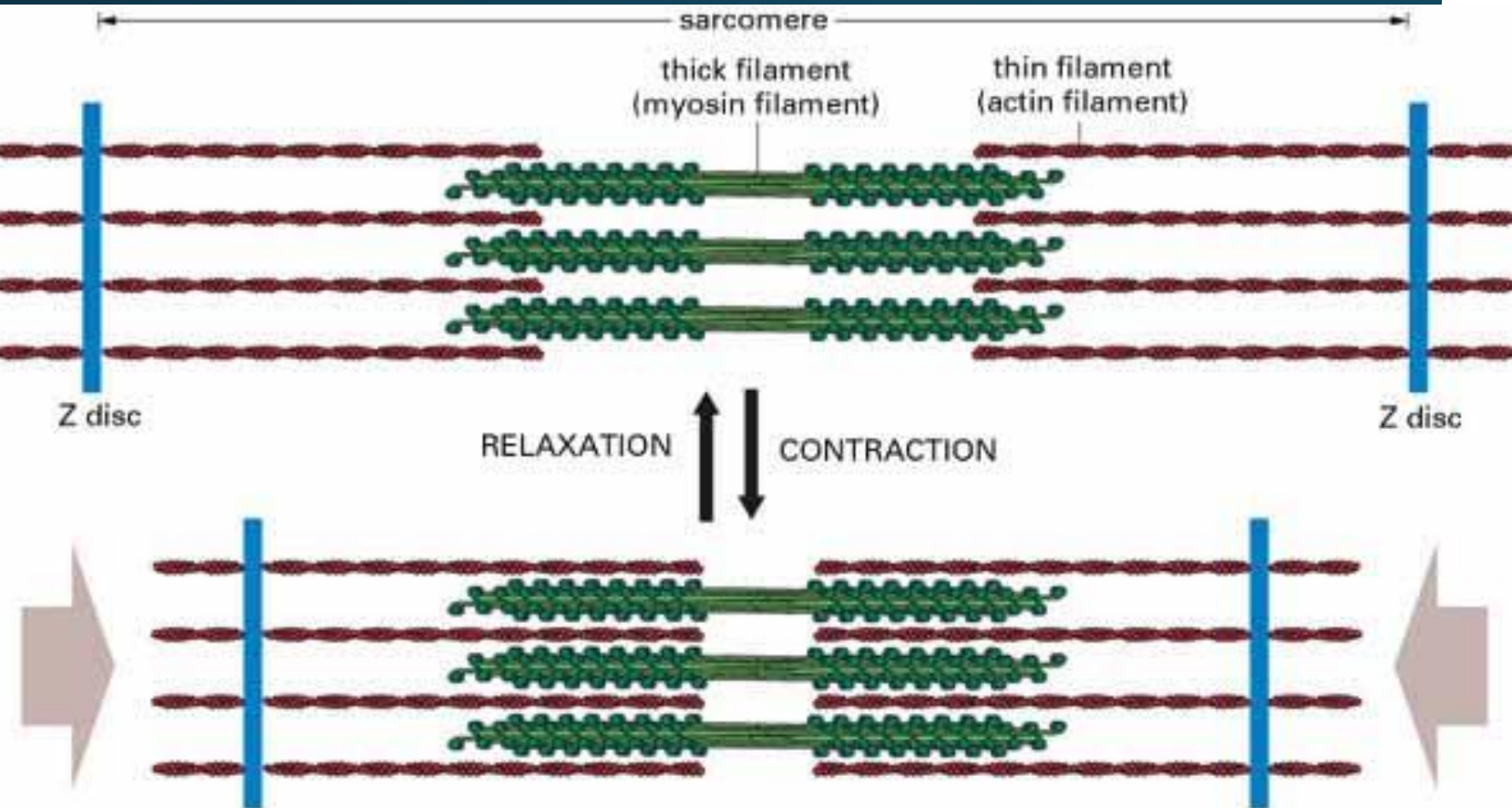
hs-cTnT was found to have a very high negative predictive value for MI (5,11).

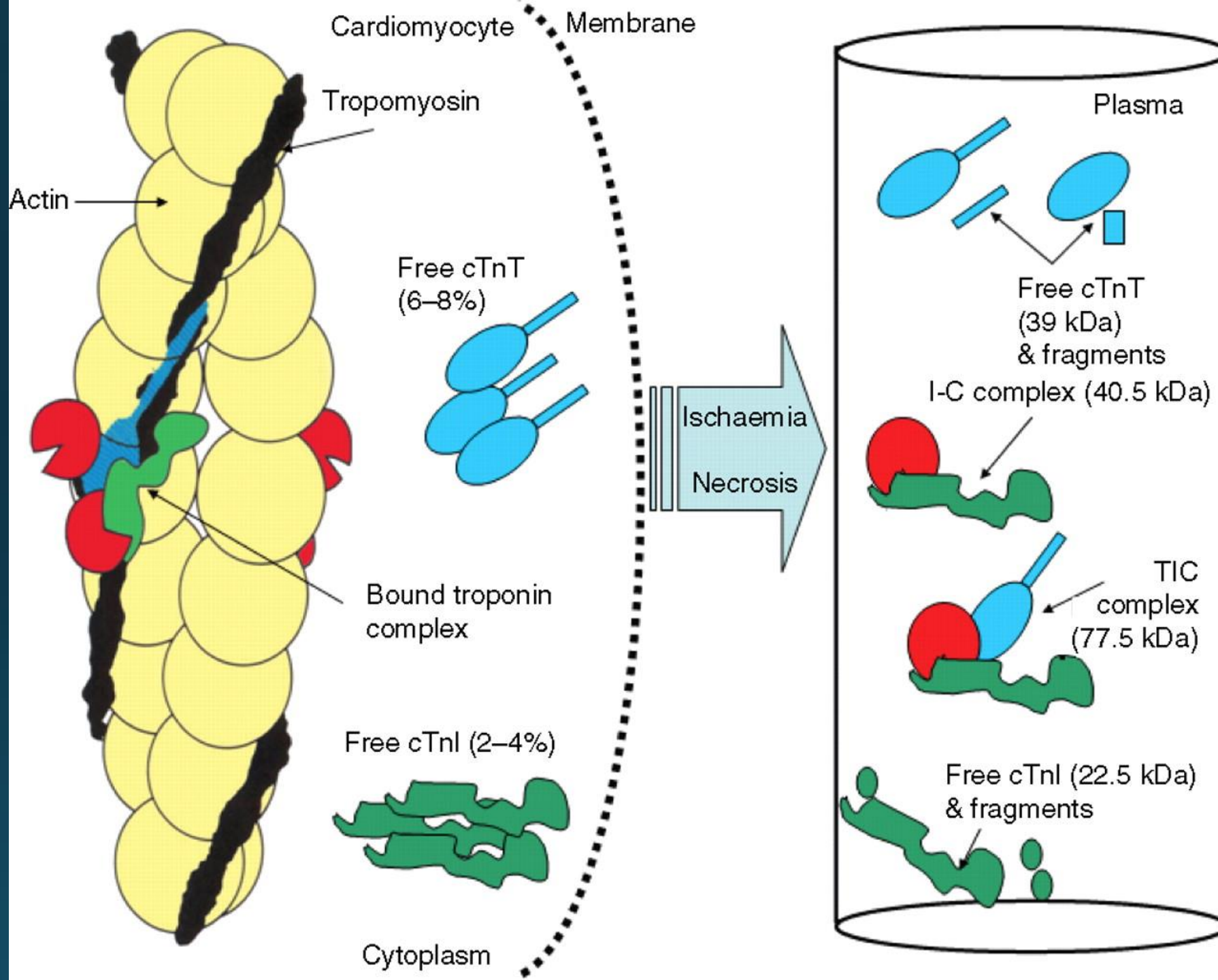
We hypothesized that all patients with chest pain who have an initial hs-cTnT level of <5 ng/l and no signs of ischemia on an ECG have a minimal risk of MI or death within 30 days, and can be safely discharged directly from the ED.

Methods

Study population. This study included all patients

What is Troponin?





Third Universal Definition of Myocardial Infarction 2007

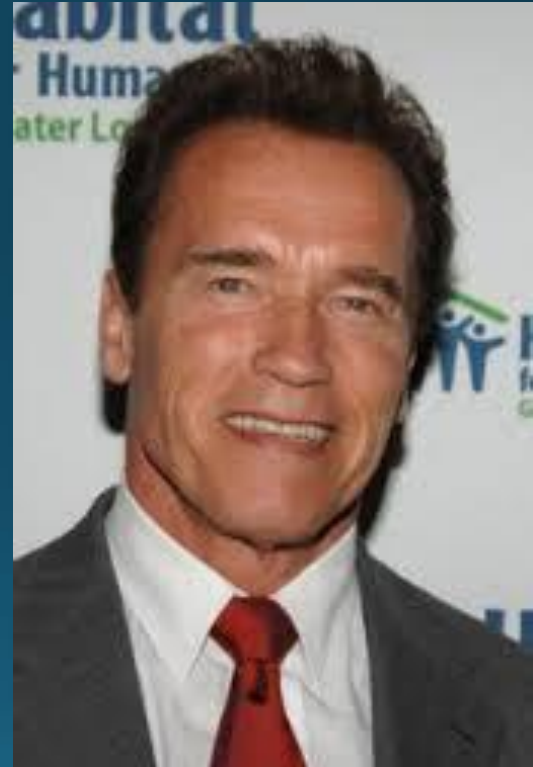
- **Type 1: Spontaneous myocardial infarction** Spontaneous myocardial infarction related to atherosclerotic plaque rupture, ulceration, Assuring, erosion, or dissection with resulting intraluminal thrombus in one or more of the coronary arteries leading to decreased myocardial blood flow or distal platelet emboli with ensuing myocyte necrosis. The patient may have underlying severe CAD but on occasion non-obstructive or no CAD.
- **Type 2: Myocardial infarction secondary to an ischemic imbalance** In instances of myocardial injury with necrosis where a condition other than CAD contributes to an imbalance between myocardial oxygen supply and/or demand, e.g. coronary endothelial dysfunction, coronary artery spasm, coronary embolism, tachy-/brady-arrhythmias, anemia, respiratory failure, hypotension, and hypertension with or without LVH.
- **Type 3: Myocardial infarction resulting in death when biomarker values are unavailable** Cardiac death with symptoms suggestive of myocardial ischemia and presumed new ischemic ECG changes or new LBBB, but death occurring before blood samples could be obtained, before cardiac biomarker could rise, or in rare cases cardiac biomarkers were not collected.
- **Type 4a: Myocardial infarction related to percutaneous coronary intervention (PCI)** Myocardial infarction associated with PCI is arbitrarily defined by elevation of cTn values $>5 \times$ 99th percentile URL in patients with normal baseline values (<99 th percentile URL) or a rise of cTn values $>20\%$ if the baseline values are elevated and are stable or falling. In addition, either (i) symptoms suggestive of myocardial ischemia, or (ii) new ischemic ECG changes or new LBBB, or (iii) angiographic loss of patency of a major coronary artery or a side branch or persistent slow- or no-flow or embolization, or (iv) imaging demonstration of new loss of viable myocardium or new regional wall motion abnormality are required.
- **Type 4b: Myocardial infarction related to stent thrombosis** Myocardial infarction associated with stent thrombosis is detected by coronary angiography or autopsy in the setting of myocardial ischemia and with a rise and/ or fall of cardiac biomarkers values with at least one value above the 99th percentile URL.
- **Type 5: Myocardial infarction related to coronary artery bypass grafting (CABG)** Myocardial infarction associated with CABG is arbitrarily defined by elevation of cardiac biomarker values $>10 \times$ 99th percentile URL in patients with normal baseline cTn values (<99 th percentile URL). In addition, either (i) new pathological Q waves or new LBBB, or (ii) angiographic documented new graft or new native coronary artery occlusion, or (iii) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality.

Third Universal Definition of Myocardial Infarction 2007

- Type 1: Spontaneous myocardial infarction related to atherosclerotic plaque rupture, ulceration, fissuring, erosion, or dissection with resulting intraluminal thrombus leading to decreased myocardial blood flow or distal platelet emboli with ensuing myocyte necrosis.
- Type 2: Myocardial infarction secondary to an ischemic imbalance where a condition other than CAD contributes to an imbalance between myocardial oxygen supply and/or demand
- Type 3: Myocardial infarction resulting in death when biomarker values are unavailable
- Type 4a: Myocardial infarction related to percutaneous coronary intervention (PCI)
- Type 4b: Myocardial infarction related to stent thrombosis
- Type 5: Myocardial infarction related to coronary artery bypass grafting

Why is Schwarzenegger's trop up?

- A: Cardiac contusions following fall during a stunt
- B: Steroid induced hypertrophic cardiomyopathy
- C: Cardiac surgery
- D: Four day long heart attack that left his heart looking like "a basketball filled with ricotta cheese"

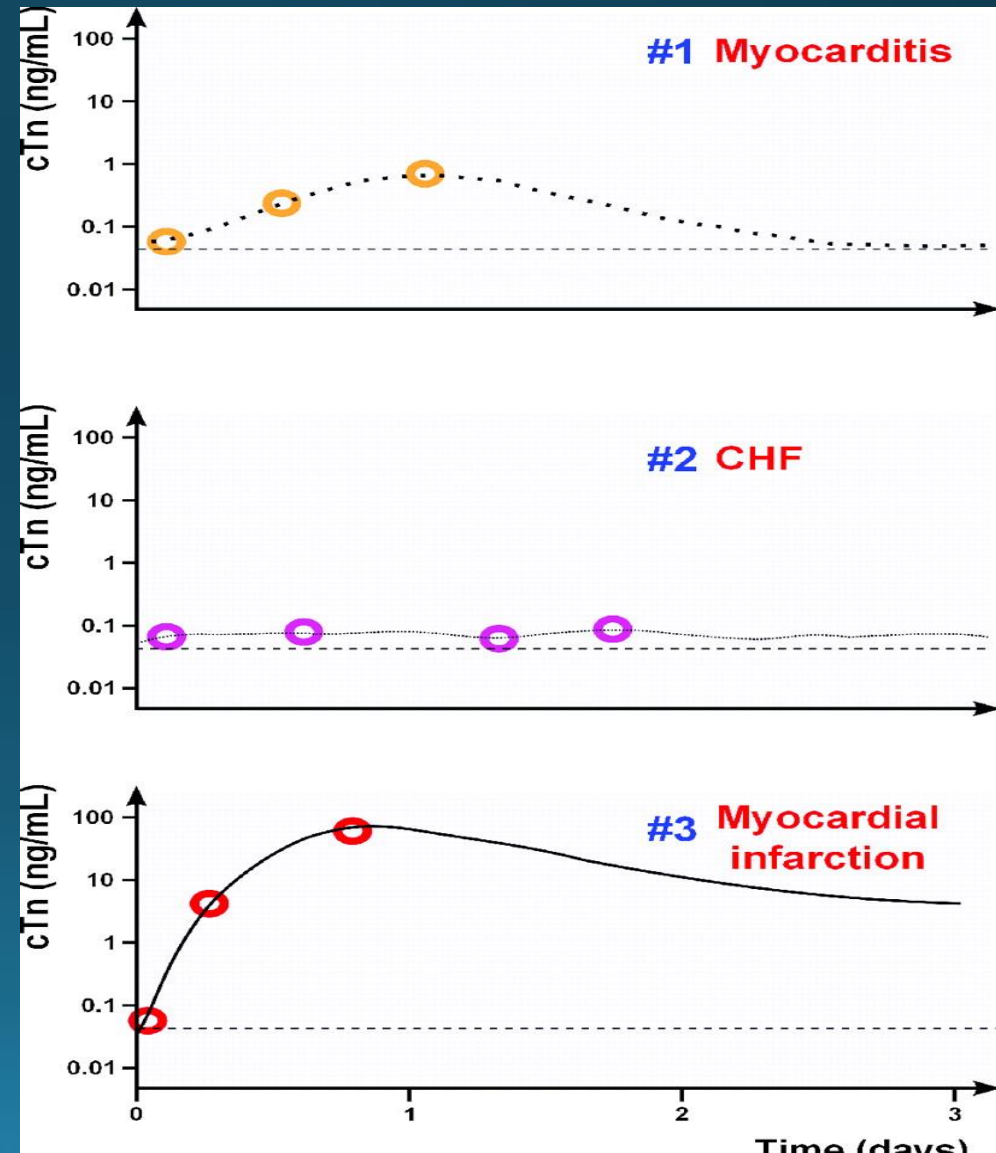


Troponin Kinetics

- Patient 1
 - 48-year-old man
 - chest discomfort lasting 2 hours and a 3-day history of flu-like symptoms
 - ECG showed diffuse global ST-segment changes
- Patient 2
 - 60-year-old woman
 - PMHx heart failure
 - shortness of breath, leg oedema
 - ECG showed nonspecific inferior T-wave changes
- Patient 3
 - 54-year-old man
 - PMHx diabetes mellitus
 - chest discomfort lasting 1 hour
 - ECG showed dynamic lateral T-wave inversion.

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 - 54-year-old man
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- Myocarditis – direct damage to myocytes due to inflammation
- Congestive cardiac failure - Global wall stretch, degradation of contractile protein and cellular injury due to oxidative stress and neurohumoral factors
- NSTEMI – microemboli causing blockage of microvasculature and infarction

Type 2 MI

- Supply/demand ischaemia
- Increased demand
- Reduced capacity for supply owing to existing stenosis

Type 2 MI

Reduced supply:

- Anaemia defined as a haemoglobin concentration <9.0 g/dL for men and <8.0 g/dL for women;
- Shock defined as systolic blood pressure <90 mm Hg together with signs of organ dysfunction
- Bradyarrhythmia requiring medical treatment or cardiac pacing;
- Coronary embolus
- Respiratory failure with an arterial oxygen tension <8 kPa and clinical signs of acute respiratory failure lasting 20 minutes.

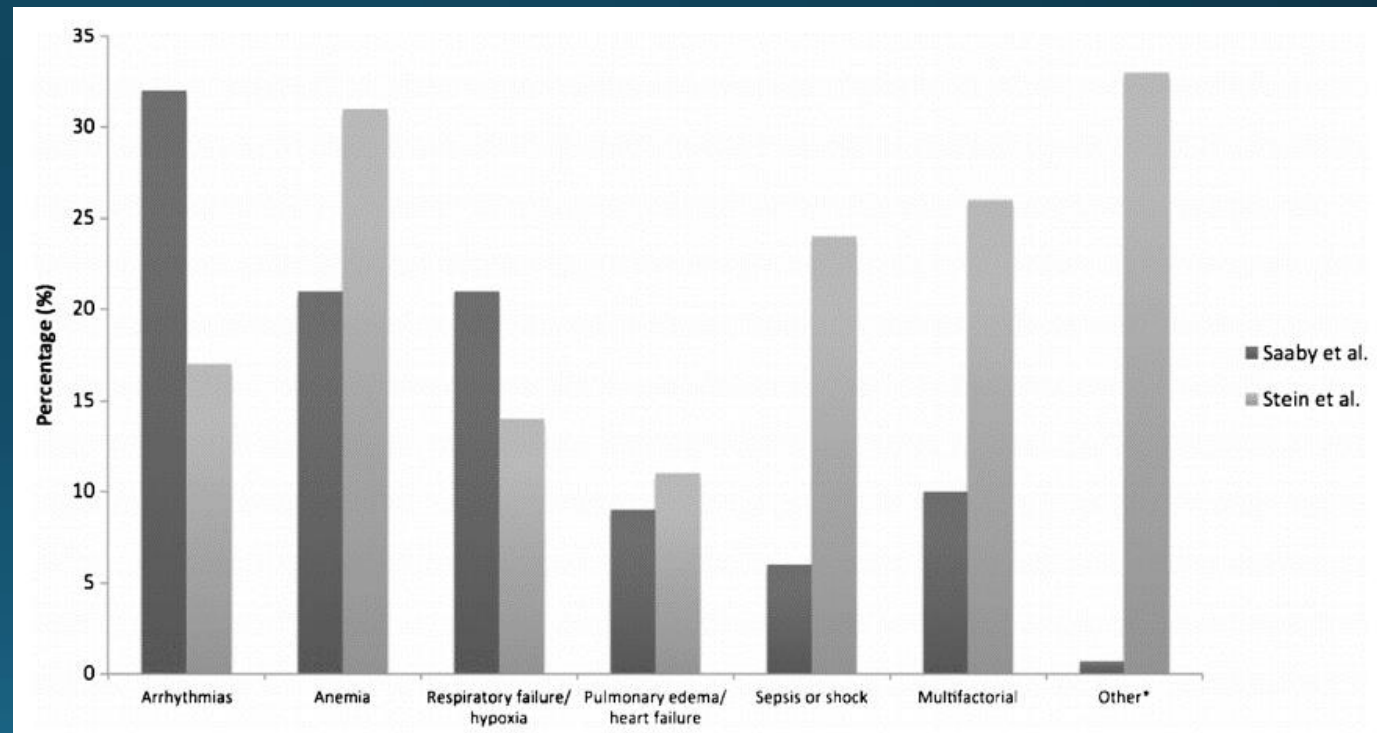
Increased oxygen demand:

- Ventricular tachyarrhythmia lasting 20 minutes;
- Supraventricular tachyarrhythmia lasting 20 minutes with a ventricular rate >150 beats/min;
- Hypertensive pulmonary edema defined as the presence of a systolic blood pressure >160 mm Hg, signs of pulmonary edema, and a need for treatment with nitrates or diuretics
- Arterial hypertension with a systolic blood pressure >160 mm Hg and concomitant left ventricular hypertrophy identified by echocardiography or electrocardiogram.

Problems with studies in Type 2 MI

- Prevalence varies in studies as different criteria and different study populations used

- Critically ill patients: 43% (Lim et al 2006)
- Postop non cardiac surgery: 5-11% (Lansberg 2009)
- All patients with troponin elevation: varies between 4.5% (Stein, ACSIS study, 2014) and 29% (Javed et al 2009)



- We do know that Type II MI is associated with a higher mortality than Type I (23.9% vs 8.6% - Stein et al)

Nonischaemic Myocardial Injury

- Patients with critical illness
 - Sepsis
 - Respiratory failure
- Patients with chronic conditions associated with low grade ongoing myocardial injury
 - Severe heart failure
 - Renal failure
- Pulmonary embolism
 - Acute right ventricular strain
- Cardiotoxic chemotherapy

Other proposed aetiologies of troponin rise

- DIC processes and microemboli
- Endothelial dysfunction and microvascular coronary disease
- Inflammatory changes
- Direct toxicity of circulating neurohormones

Other causes of troponin elevation

- Strenuous exercise / ultra-endurance athletes
 - Ventricular stretch, cytosolic troponin release
- Rhabdomyolysis
 - Cross-reactivity when skeletal muscle troponin is present in high quantities

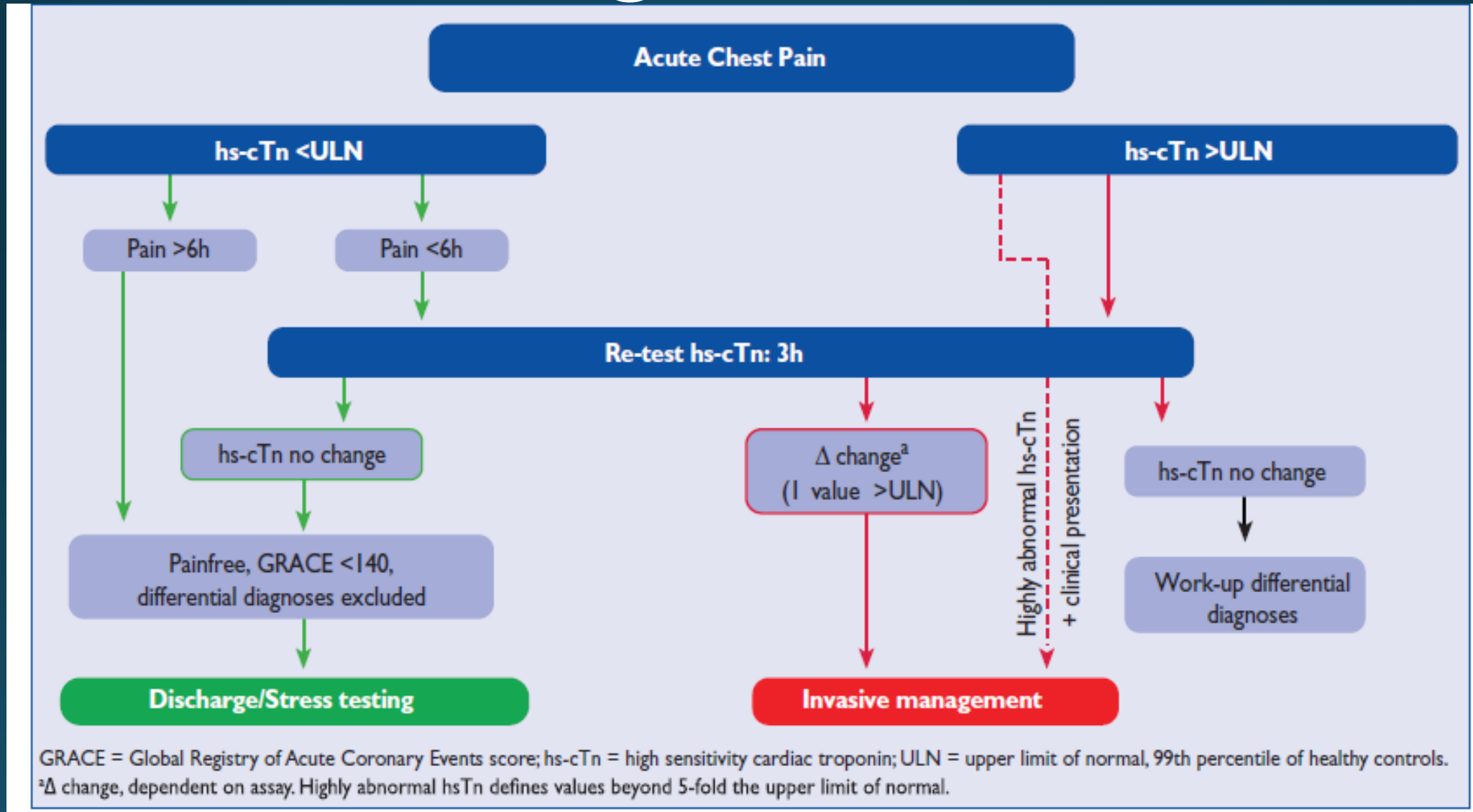
Why is Miley's troponin getting hearts racing?

- A Running the New York marathon in 2012 with only 1 month of training
- B Hereditary dilated cardiomyopathy
- C Supraventricular tachycardia
- D Recurrent rounds of ECT following the release of the single 'wrecking ball'



Using troponin to diagnose ACS

ESC 2015 ACS guideline



ESC 2015 ACS guideline

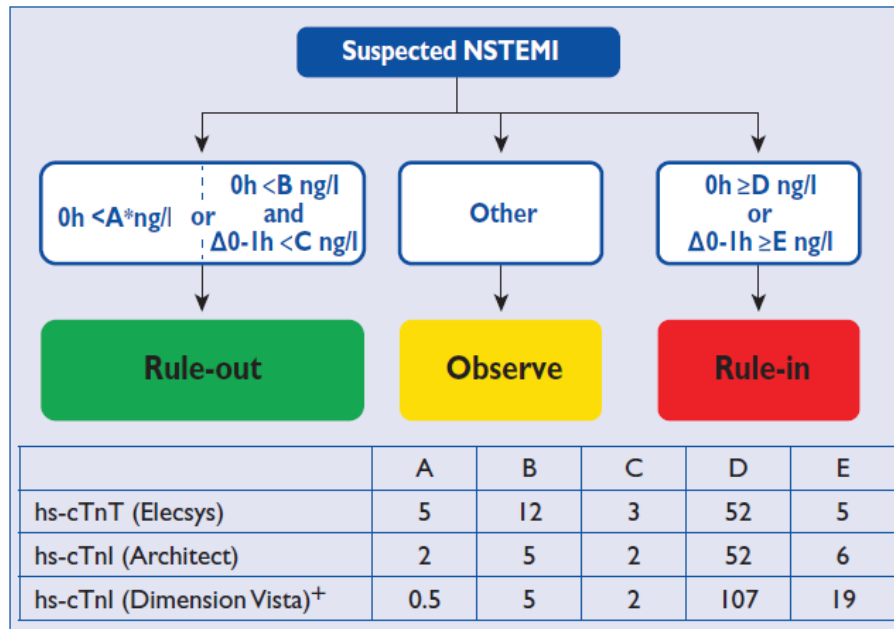


Figure 3 0 h/1 h rule-in and rule-out algorithms using high-sensitivity cardiac troponins (hs-cTn) assays in patients presenting with suspected non-ST-elevation myocardial infarction (NSTEMI) to the emergency department. 0 h and 1 h refer to the time from first blood test. NSTEMI can be ruled-out already at presentation,



Myocardial infarction (acute): Early out using high-sensitivity troponin I (Elecsys Troponin T high-sensitive, ARCHITECT STAT High Sensitive Troponin-I and AccuTnI+3 assays)

Diagnostics guidance

Published: 1 October 2014

nice.org.uk/guidance/dg15

This guidance considers high-sensitivity troponin tests to be those that have a coefficient of variation of 10% or less at the 99th percentile (the upper limit of the reference population), and are able to detect cardiac troponin in at least 50% of the reference population. These recommendations refer to the use of these tests with early rule-out protocols.

NICE is aware that there is a wide range of non-high-sensitivity troponin tests available to the NHS which are used to rule-out non-ST-segment-elevation myocardial infarction (NSTEMI). The evidence for these tests has not been assessed in this guidance, and the recommendation therefore, do not relate to the use of non-high-sensitivity troponin tests.

- 1.1 The Elecsys Troponin T high-sensitive assay and ARCHITECT STAT High Sensitive Troponin-I assay are recommended as options for the early rule out of non-ST-segment-elevation myocardial infarction (NSTEMI) in people presenting to an emergency department with chest pain and suspected acute coronary syndrome.
- 1.2 The assays are recommended for use with 'early rule-out protocols', which typically include a blood sample for cardiac troponin I or T taken at initial assessment in an emergency department and a second blood sample taken after 3 hours. Laboratories should report absolute values and the upper reference limit should be set at the 99th percentile. Results should be interpreted along with clinical judgement and the results of clinical assessment. Healthcare professionals should take into account the pre-test probability of NSTEMI, the length of time since the suspected acute coronary syndrome, the possibility of chronically elevated troponin levels in some patients and that 99th percentile thresholds for troponin I and T may differ between sexes. When NSTEMI is not ruled out using an 'early rule-out protocol', further clinical assessment is required to determine whether a diagnosis of NSTEMI is appropriate.
- 1.3 The AccuTnI+3 assay is only recommended for use in clinical research, for early rule out of NSTEMI in people presenting to an emergency department with chest pain and suspected acute coronary syndrome (see [section 7.1](#)).

ABSTRACT

Objective To validate the National Institute for Health and Care Excellence (NICE) recommended algorithms for high-sensitivity troponin (hsTn) assays in adults presenting with chest pain.

Methods International post hoc analysis of three prospective, observational studies from tertiary hospital emergency departments. The primary endpoint was cardiac death or acute myocardial infarction (AMI) within 24 hours of presentation, and the secondary endpoint was major adverse cardiac events (MACE) at 30 days.

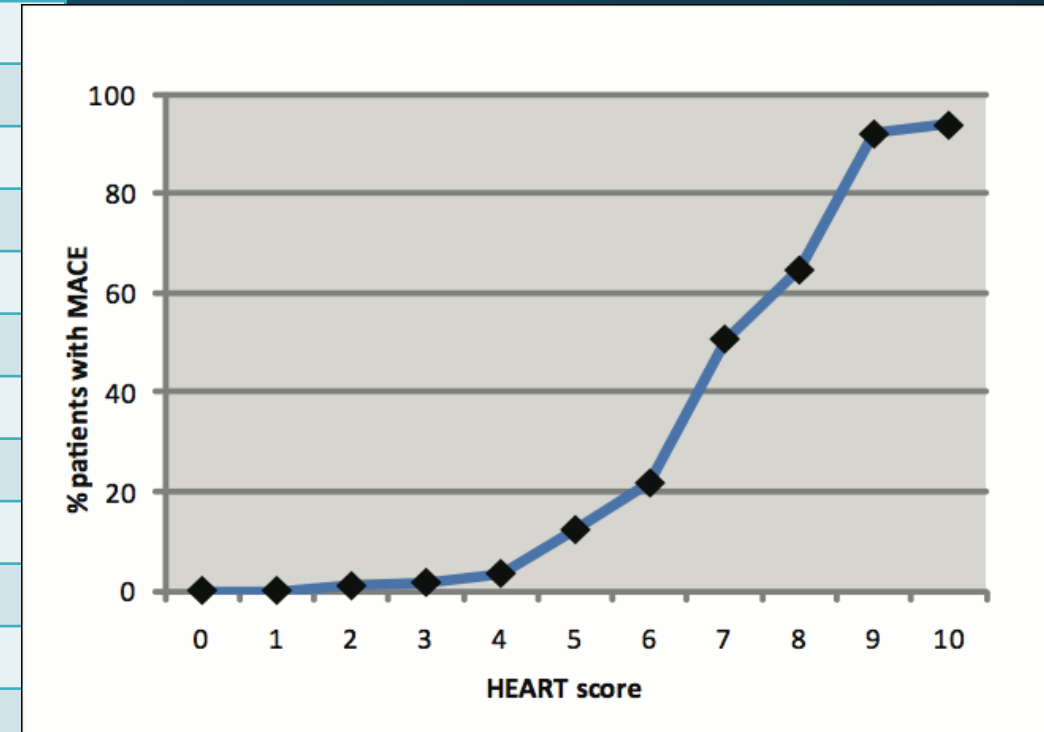
Results 15% of patients were diagnosed with non-ST elevation myocardial infarction (MI) on admission. The hsTnI algorithm classified 2506/3128 (80.1%) of patients as 'ruled out' with 50 (2.0%) missed MI. 943/3128 (30.1%) of patients had a troponin I level below the limit of detection on admission with 2 (0.2%) missed MI. For the hsTnT algorithm, 1794/3374 (53.1%) of patients were 'ruled out' with 7 (0.4%) missed MI. 490/3374 (14.5%) of patients had a troponin T below the limit of blank on admission with no MI. MACE at 30 days occurred in 10.7% and 8.5% of patients 'ruled out' defined by the hsTnI and hsTnT algorithms, respectively.

Conclusions The NICE algorithms could identify patients with low probability of AMI within 2 hours; however, neither strategy performed as predicted by the NICE diagnostic guidance model. Additionally, the rate of MACE at 30 days was sufficiently high that the algorithms should only be used as one component of a more extensive model of risk stratification.

Trial registration number ACTRN12611001069943, NCT00470587; post-results.

HEART Score

History	Highly suspicious	2
	Moderately suspicious	1
	Slightly suspicious	0
ECG	Significant ST depression	2
	Non-specific repolarisation disturbance	1
	Normal	0
Age	>65 years	2
	45-65 years	1
	<45 years	0
Risk Factors	3 or more risk factors OR history of atherosclerotic disease	2
	1 or 2 risk factors	1
	No risk factors	0
Troponin	>3x normal limit [>50]	2
	1-3x normal limit [$14-49$]	1
	<normal limit [<14]	0



<http://www.heartscore.nl/>

HEART Score

Appendix 2. Sensitivity analysis 3

Analysis	Risk stratification strategy	Early discharge (95% CI)	Sensitivity (95% CI ^a)	-LR (95% CI)	NRI (95% CI)	Missed ACS rate (95% CI)
Primary	Unstructured	13.5% (11.5–15.8%)	97.7% (94.7–99.2%)	0.14 (0.06–0.33)	Reference	0.5% (0.2–1.2%)
6 hour troponin added	Unstructured	9.4% (7.7–11.4%)	98.2% (95.3–99.5%)	0.16 (0.06–0.42)	-4.7% (-6.2, -3.5)	0.4% (0.1–1.1%)
Primary	NACPR	4.4% (3.3–5.7%)	100% (98.0–100%)	0 (0–0.55)	Reference	0.0% (0–0.5%)
6 hour troponin added	NACPR	3.2% (2.3–4.5%)	100% (98.0–100%)	0 (0–0.77)	-1.5% (-2.5, -1.0)	0.0% (0–0.5%)
Primary	HEART	20.2% (17.8–22.8%)	99.1% (96.5–100%)	0.04 (0.01–0.14)	Reference	0.2% (0–0.8%)
6 hour troponin added	HEART	14.5% (12.4–16.8%)	99.6% (97.2–100%)	0.03 (0.0–0.18)	-6.7% (-8.5, -5.4%)	0.1% (0.0–0.6%)

Comparison of decision rules combined with 0 and 3 hour serial troponins versus 0, 3, and 6 hour serial troponins. ACS = acute coronary syndrome, -LR = negative likelihood ratio, NRI = net reclassification improvement, CI = confidence interval, NACPR = North American Chest Pain Rule.

Treating a raised troponin

- What does aspirin, clopidogrel and fondaparinux do?

A: Thrombolyses any clot present in large vessels

B: Unblocks microcirculation to improve blood supply to ischaemic tissue

C: Reduces risk of further emboli/clot forming at site of ruptured plaque

Treating a raised troponin

- Thrombolytic therapy is beneficial in patients with STEMI
- But is not effective in UA or NSTEMI and may be harmful.
- The nonoccluding thrombi that are present are primarily grayish-white (ie, platelet-rich), and therefore less likely to respond to thrombolytic therapy
- In contrast, thrombi are almost always reddish (ie, fibrin-rich) in patients with STEMI
- In addition, microvascular perfusion is often reduced in patients with UA or NSTEMI; as a result, the ongoing mechanism of ischemia is more likely embolization and endothelial dysfunction rather than epicardial vessel occlusion

Differential sensitivity of erythrocyte-rich and platelet-rich arterial thrombi to lysis with recombinant tissue-type plasminogen activator. Jang (1989)

Treating a raised troponin

- What benefit do you get from aspirin, clopidogrel and fondaparinux?
- A 50% reduction in fatal MI
- B 25% reduction in 30-day adverse events
- C 5% reduction in 30-day adverse events

Treating a raised troponin

- Aspirin
 - Antithrombotic trialists collaboration
 - Reduction in 12 month nonfatal MI, stroke or cardiovascular death from 14.2 to 10.4%
- Clopidogrel
 - CURE trial
 - Reduction in 9-month combined endpoint of cardiovascular death, nonfatal MI or stroke from 11.4 to 9.3%
- Heparin
 - FRISC trial
 - Reduction in 6-day death or repeat MI from 4.8 to 1.8%

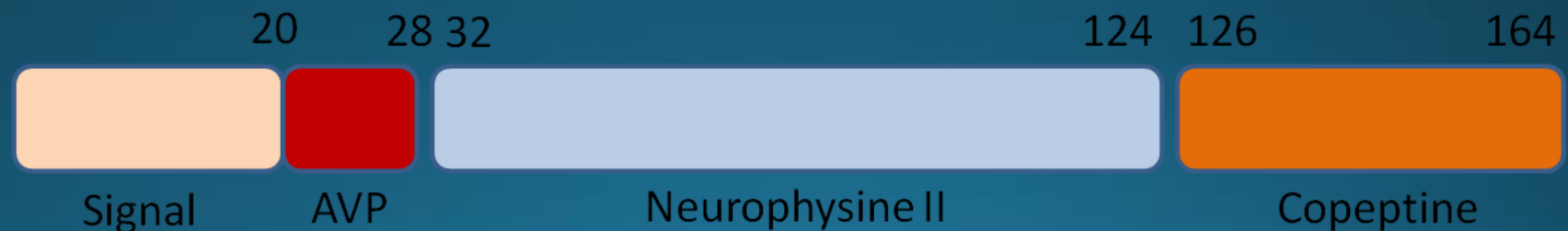
Why might Hemmingway have a Heavy Heart?

- A: Alcohol induced cardiomyopathy
- B: Hereditary haemochromatosis
- C: Ventricular tachyarrhythmia
- D: Piano fell on him



New Biomarkers

- Heart type fatty acid binding protein
 - Involved in fatty acid metabolism and abundant in myocytes
 - Released in AMI
- Copeptin
 - ADH pre-pro-hormone
 - Early rise in AMI... but also in heart failure and cardiogenic shock



New Biomarkers

- Panels combining troponin, copeptin and HFABP have slightly improved rule-out value for AMI, especially in early presenters, compared to troponin alone.
 - Jacobs et al (2015). Annals of clinical biochemistry
- Derivation of new scoring systems e.g. Manchester Acute Coronary Syndromes (MACS) aimed at early discharge
 - Body et al (2014). Heart

Conclusions

- Troponin rules out MI, it does not rule it in
- Look at the change over time in troponin and consider other factors in diagnosing ACS
- There are multiple causes of an elevation in troponin – but many of these do not relate to a thrombotic or embolic event
- Only an acute plaque rupture will benefit from treatment with antiplatelet agents and heparin