

# Myokardinfarkt

## Entstehung und Bedeutung

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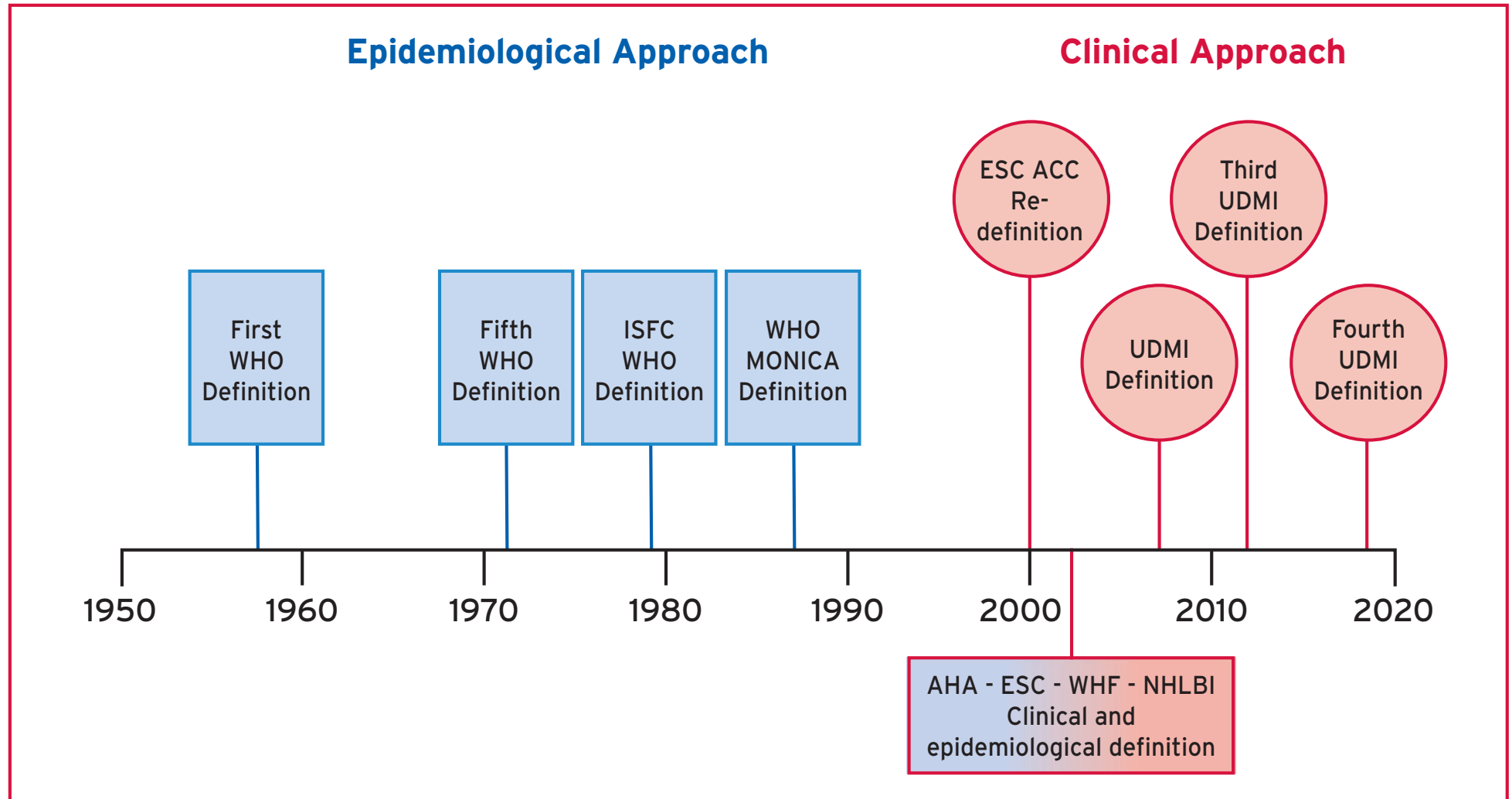
UniversitätsSpital  
Zürich

A black and white photograph of a classical marble bust of the philosopher Aristotle. The bust is shown from the chest up, facing slightly to the right. It features a full, curly beard and hair, and a serene expression. The background is dark and out of focus.

*„Das Leben beginnt mit dem  
ersten Herzschlag und endet  
mit dem letzten.“*

*Aristoteles*

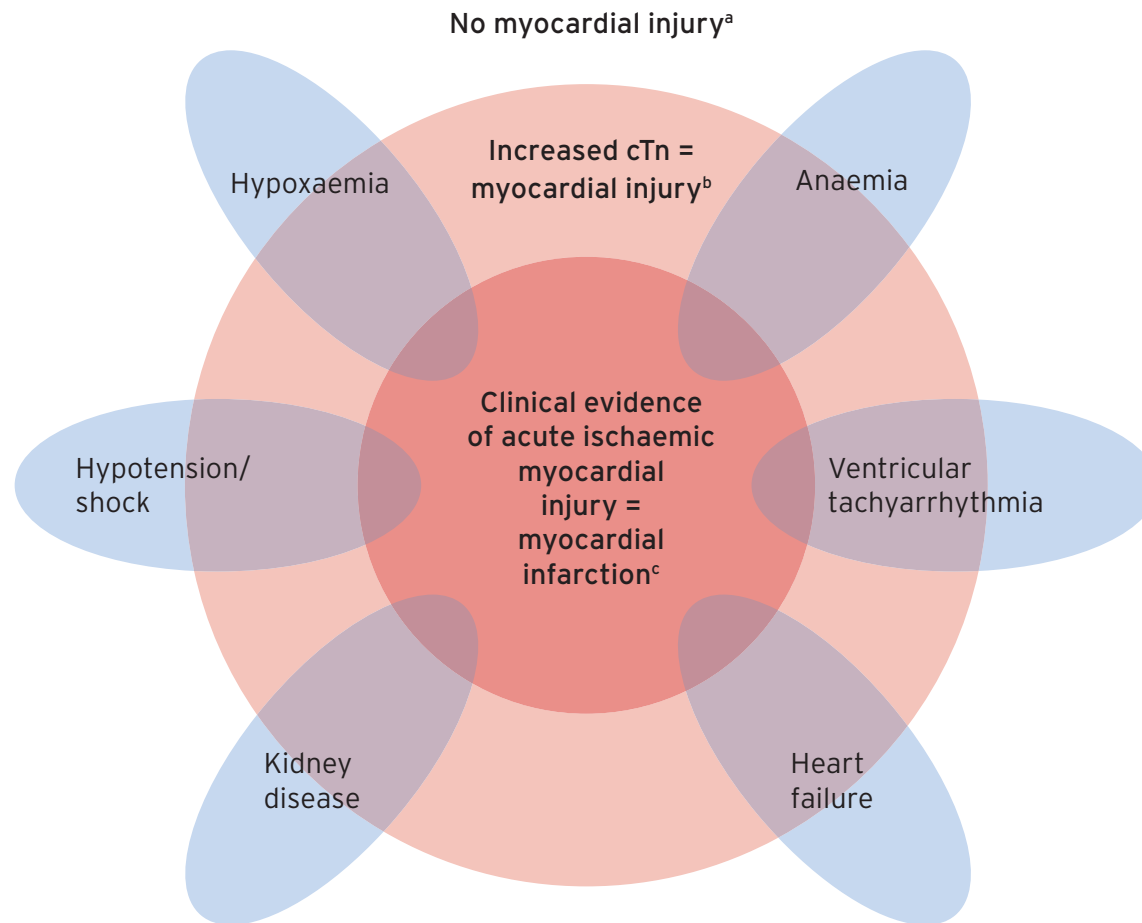
# Definition des Myokardinfarkts



# Pathophysiologie des Myokardinfarkts

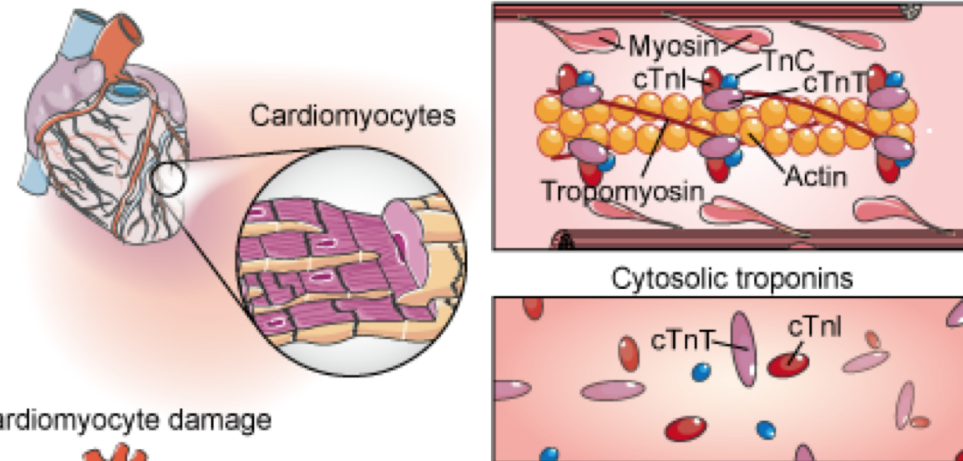
Beim Herzinfarkt gehen (definitionsgemäß) Herzmuskelzellen zugrunde und können (anders als in anderen Organen) nicht oder nicht in nennenswerter Form ersetzt werden. Der Verlust an Herzmuskelzellen führt chronisch zur Überlastung der noch vorhandenen Herzmuskelzellen und schließlich zur Herzschwäche (Herzinsuffizienz)

# Spektrum myokardialer Schädigung

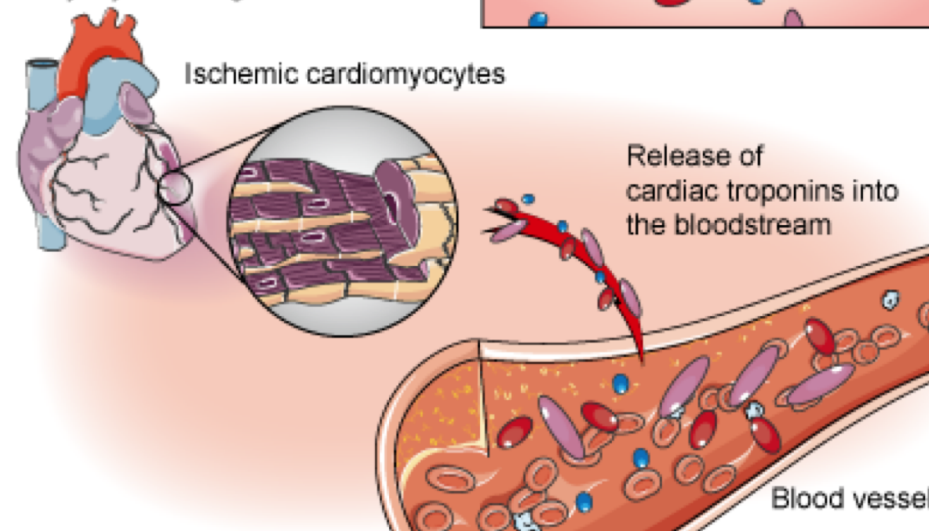


# Kardiale Biomarker - Troponine

**a** Structure of cardiac troponins



**b** Cardiomyocyte damage

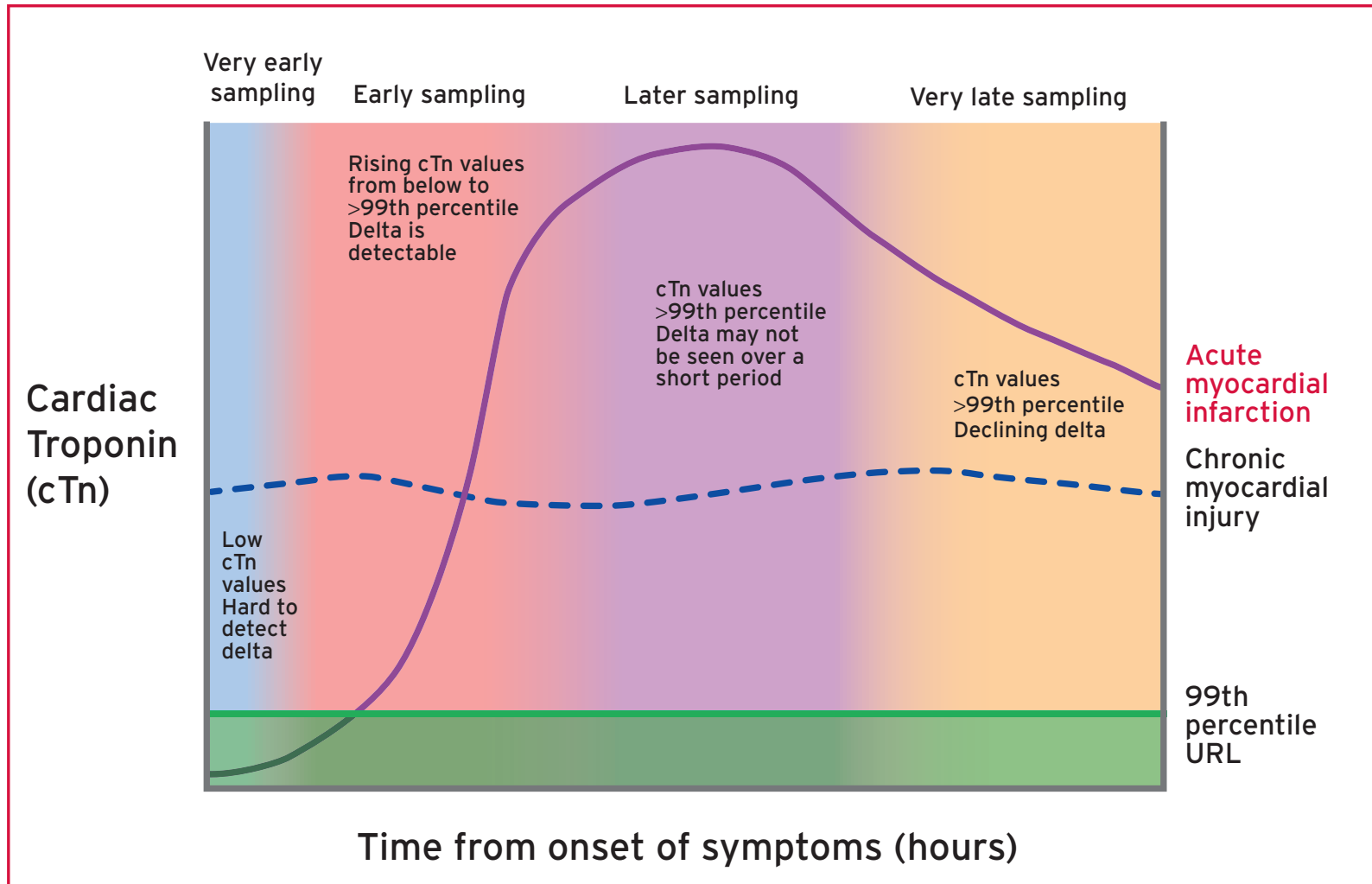


# Myokardiale Schädigung – Definition 2018

## Criteria for myocardial injury

Detection of an elevated cTn value above the 99th percentile URL is defined as myocardial injury. The injury is considered acute if there is a rise and/or fall of cTn values.

# Myokardiale Schädigung und kardiale Biomarker





# Myokardiale Schädigung - Myokardinfarkt

## Definition Myokardinfarkt:

### Criteria for acute myocardial infarction (types 1, 2 and 3 MI)

The term acute myocardial infarction should be used when there is acute myocardial injury with clinical evidence of acute myocardial ischaemia and with detection of a rise and/or fall of cTn values with at least one value above the 99th percentile URL and at least one of the following:

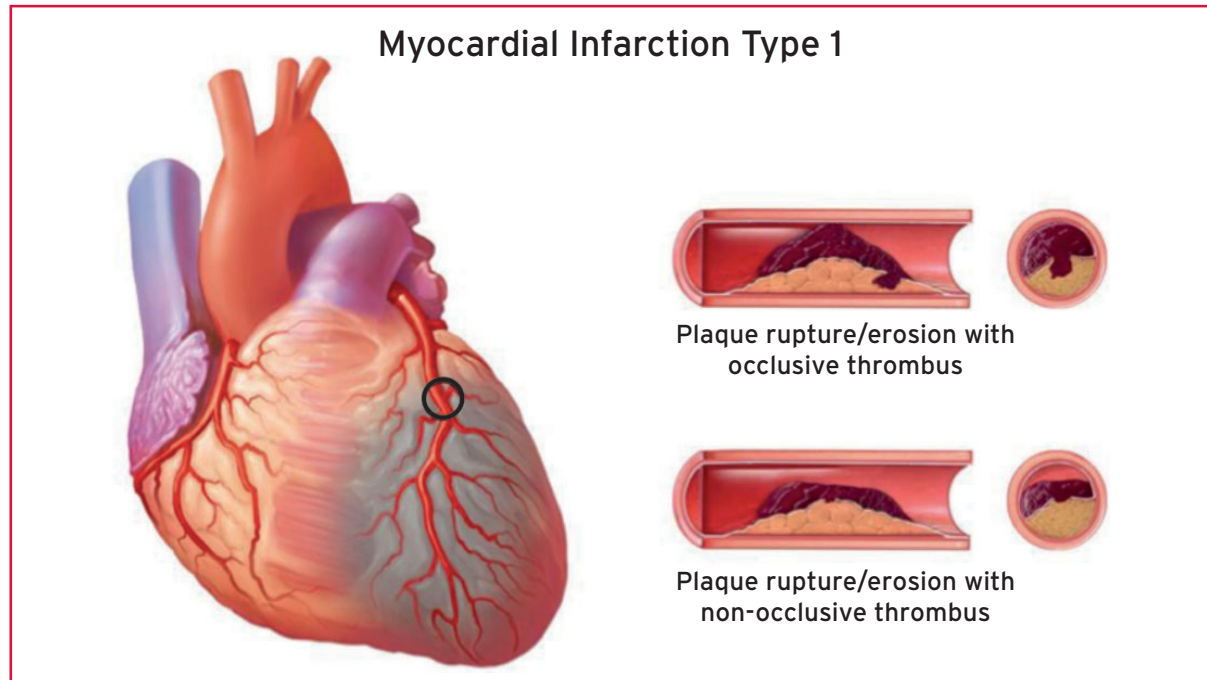
- Symptoms of myocardial ischaemia;
- New ischaemic ECG changes;
- Development of pathological Q waves;
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischaemic aetiology;
- Identification of a coronary thrombus by angiography or autopsy (not for types 2 or 3 MIs).

Post-mortem demonstration of acute athero-thrombosis in the artery supplying the infarcted myocardium meets criteria for *type 1 MI*.

Evidence of an imbalance between myocardial oxygen supply and demand unrelated to acute athero-thrombosis meets criteria for *type 2 MI*.

Cardiac death in patients with symptoms suggestive of myocardial ischaemia and presumed new ischaemic ECG changes before cTn values become available or abnormal meets criteria for *type 3 MI*.

# Myokardinfarkt Typ 1



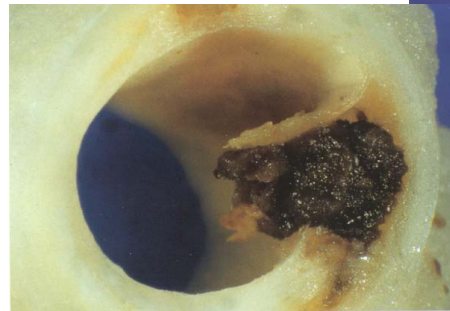
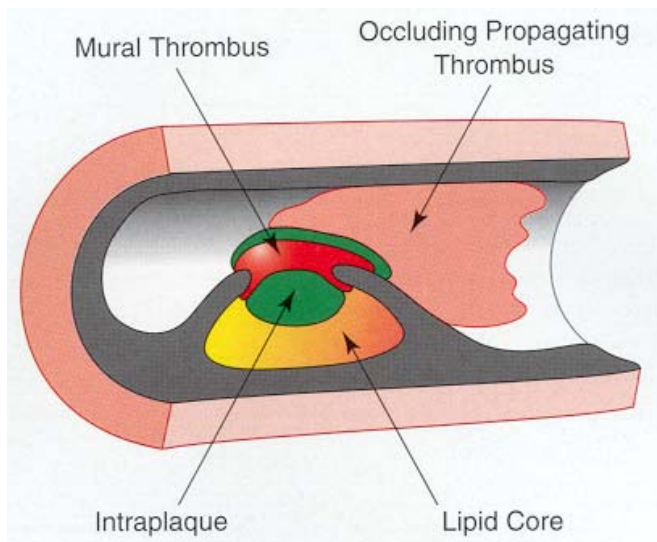
## Criteria for type 1 MI

Detection of a rise and/or fall of cTn values with at least one value above the 99th percentile URL and with at least one of the following:

- Symptoms of acute myocardial ischaemia;
- New ischaemic ECG changes;
- Development of pathological Q waves;
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischaemic aetiology;
- Identification of a coronary thrombus by angiography including intracoronary imaging or by autopsy.<sup>a</sup>

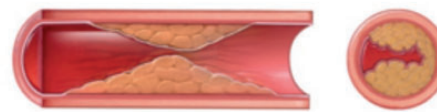
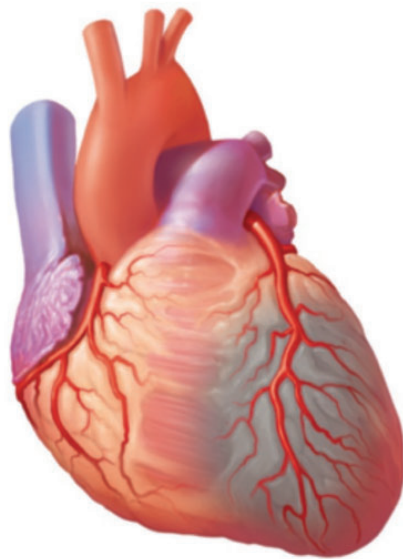
# Was passiert beim Myokardinfarkt Typ I

Plaueinstabilität/Plaqueruptur



# Myokardinfarkt Typ 2

## Myocardial Infarction Type 2



Atherosclerosis and oxygen supply/demand imbalance



Vasospasm or coronary microvascular dysfunction



Non-atherosclerotic coronary dissection



Oxygen supply/demand imbalance alone

### Criteria for type 2 MI

Detection of a rise and/or fall of cTn values with at least one value above the 99th percentile URL, and evidence of an imbalance between myocardial oxygen supply and demand unrelated to coronary thrombosis, requiring at least one of the following:

- Symptoms of acute myocardial ischaemia;
- New ischaemic ECG changes;
- Development of pathological Q waves;
- Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischaemic aetiology.

# Myokardiale Schädigung bei Infarkt

## Myocardial injury related to acute myocardial ischaemia

Atherosclerotic plaque disruption with thrombosis.

## Myocardial injury related to acute myocardial ischaemia because of oxygen supply/demand imbalance

*Reduced myocardial perfusion, e.g.*

- Coronary artery spasm, microvascular dysfunction
- Coronary embolism
- Coronary artery dissection
- Sustained bradyarrhythmia
- Hypotension or shock
- Respiratory failure
- Severe anaemia

*Increased myocardial oxygen demand, e.g.*

- Sustained tachyarrhythmia
- Severe hypertension with or without left ventricular hypertrophy

# Myokardiale Schädigung ohne Infarkt

## Other causes of myocardial injury

### *Cardiac conditions, e.g.*

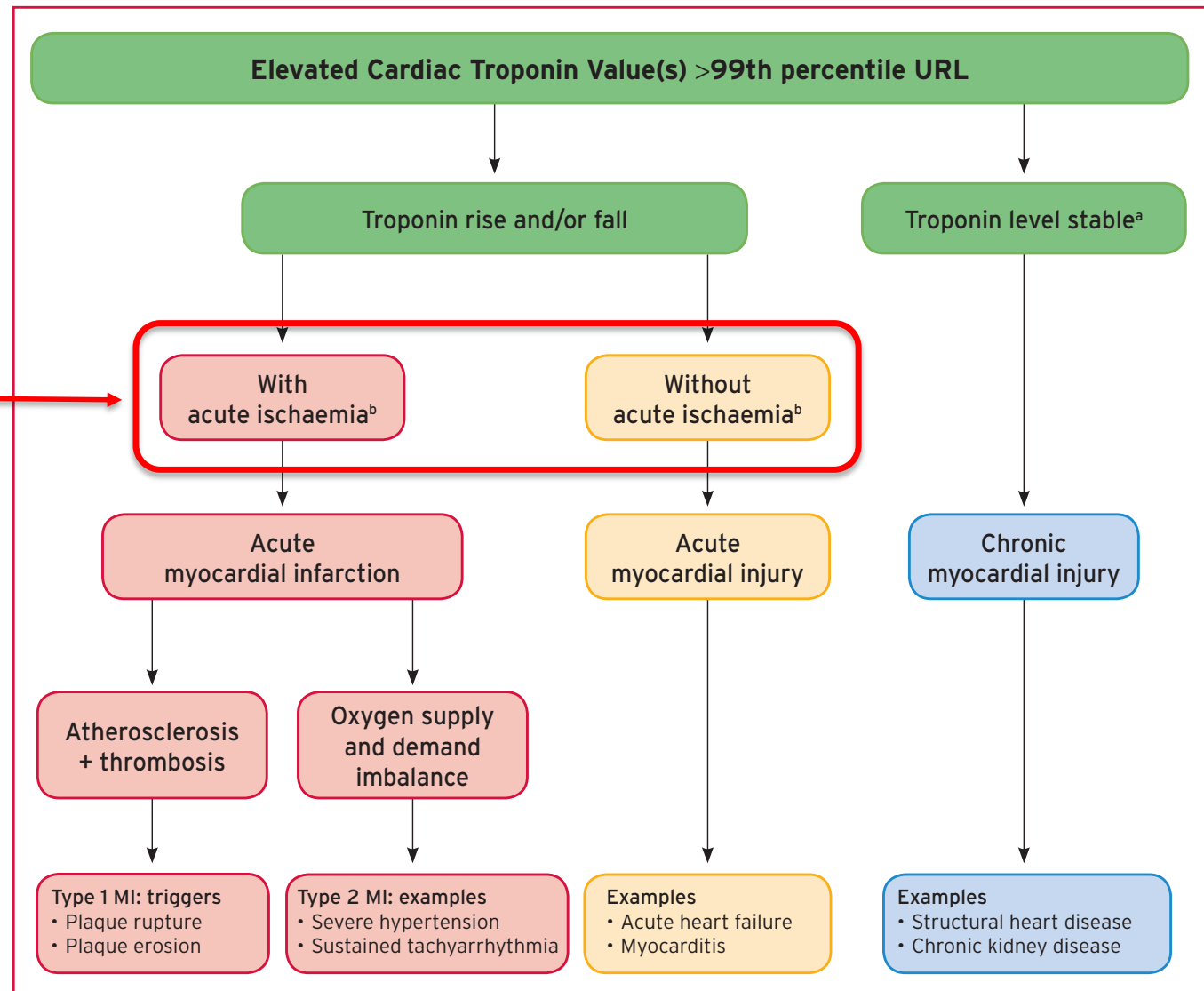
- Heart failure
- Myocarditis
- Cardiomyopathy (any type)
- Takotsubo syndrome
- Coronary revascularization procedure
- Cardiac procedure other than revascularization
- Catheter ablation
- Defibrillator shocks
- Cardiac contusion

### *Systemic conditions, e.g.*

- Sepsis, infectious disease
- Chronic kidney disease
- Stroke, subarachnoid haemorrhage
- Pulmonary embolism, pulmonary hypertension
- Infiltrative diseases, e.g. amyloidosis, sarcoidosis
- Chemotherapeutic agents
- Critically ill patients
- Strenuous exercise

# Differentialdiagnose myokardiale Ischämie

Vortestwahrscheinlichkeit →



# **Symptome Myokardinfarkt**

<b>Typische Symptome</b>	<b>70%</b>
<b>atypische Symptome</b>	<b>15%</b>
<b>Asymptomatisch („stumm“)</b>	<b>15%</b>



# Atypische Symptome Myokardinfarkt

- Herzinsuffizienz
- klassische kurzdauernde Angina-Pectoris Anfälle
- atypische Lokalisierung der Schmerzen
- zentralnervöse Symptome (ähnlich wie Schlaganfall)
- Furcht und Nervosität
- plötzliche psychische Veränderungen, Verwirrtheit
- Synkope
- überwältigende Schwäche
- Plötzliche Magenverstimmung

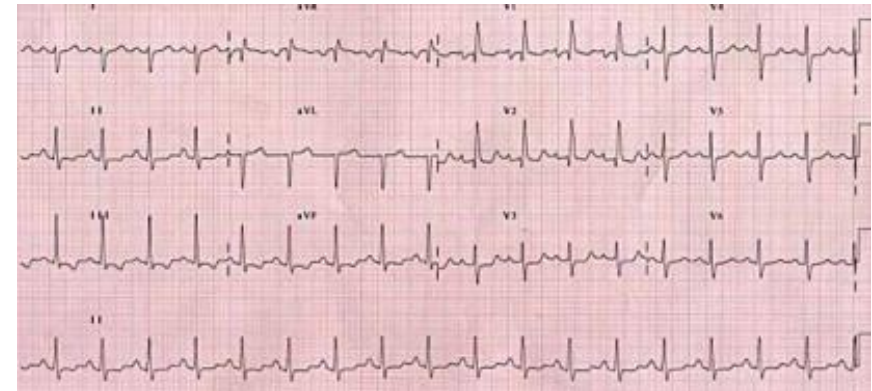
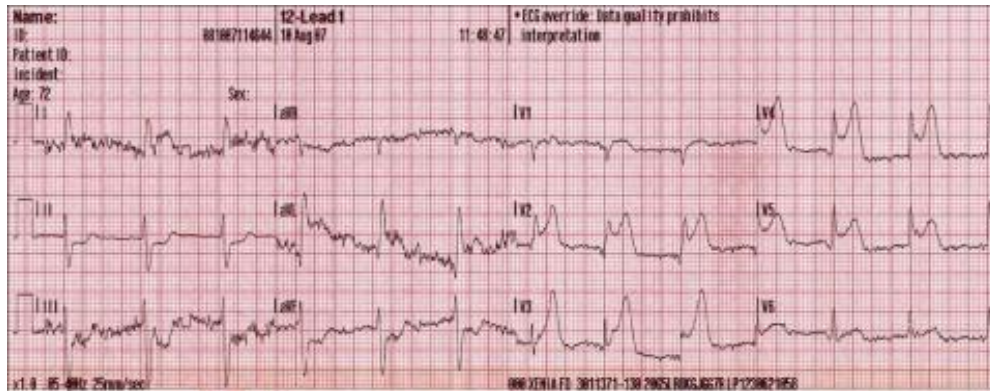
Bean WB, Lancet 1977; Masquerade of Myocardial Infarction

# Myokardinfarkt (akutes Koronarsyndrom)

STEMI

NSTEMI

Instable Angina



Troponin

+

-

# EKG Veränderungen bei ACS

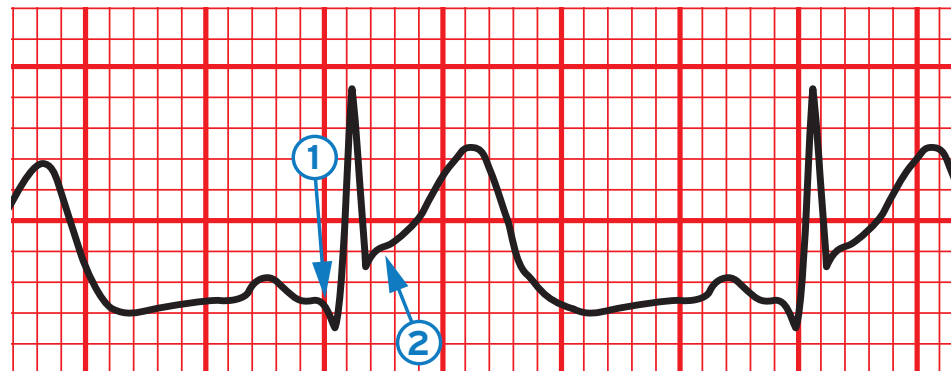
## ST-elevation

New ST-elevation at the J-point in two contiguous leads with the cut-point:  $\geq 1$  mm in all leads other than leads  $V_2$ - $V_3$  where the following cut-points apply:  $\geq 2$  mm in men  $\geq 40$  years;  $\geq 2.5$  mm in men  $< 40$  years, or  $\geq 1.5$  mm in women regardless of age.<sup>a</sup>

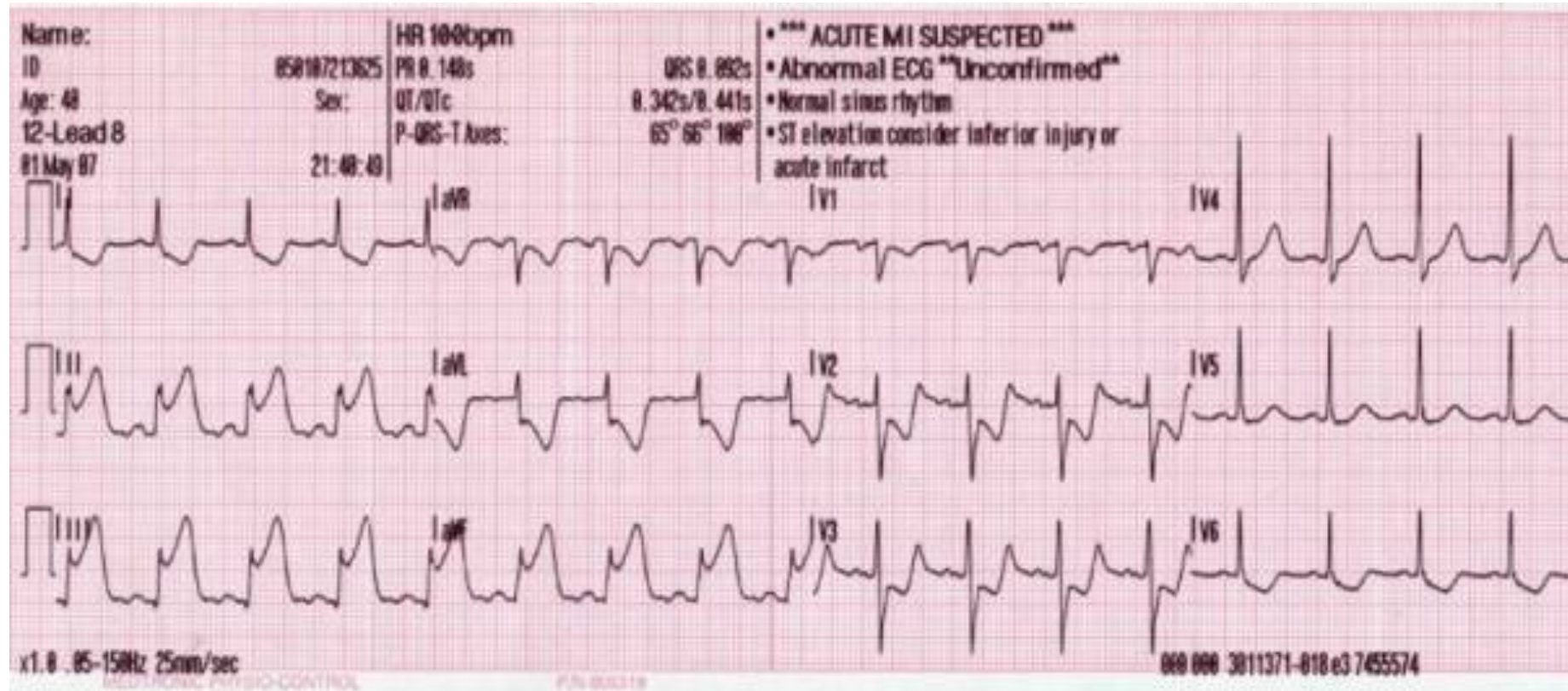
## ST-depression and T wave changes

New horizontal or downsloping ST-depression  $\geq 0.5$  mm in two contiguous leads and/or T inversion  $> 1$  mm in two contiguous leads with prominent R wave or R/S ratio  $> 1$ .

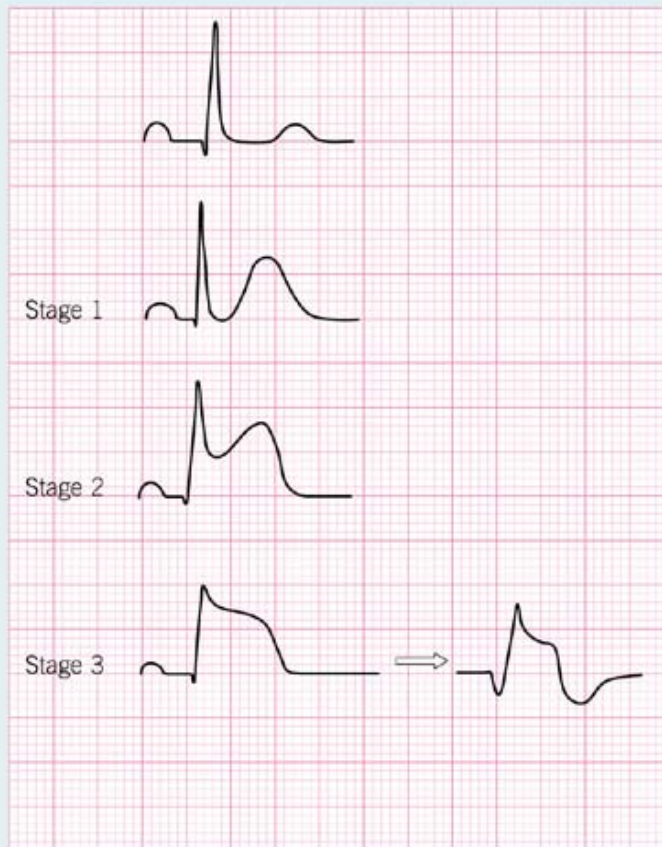
©ESC/ACC/AHA/WHF 2018



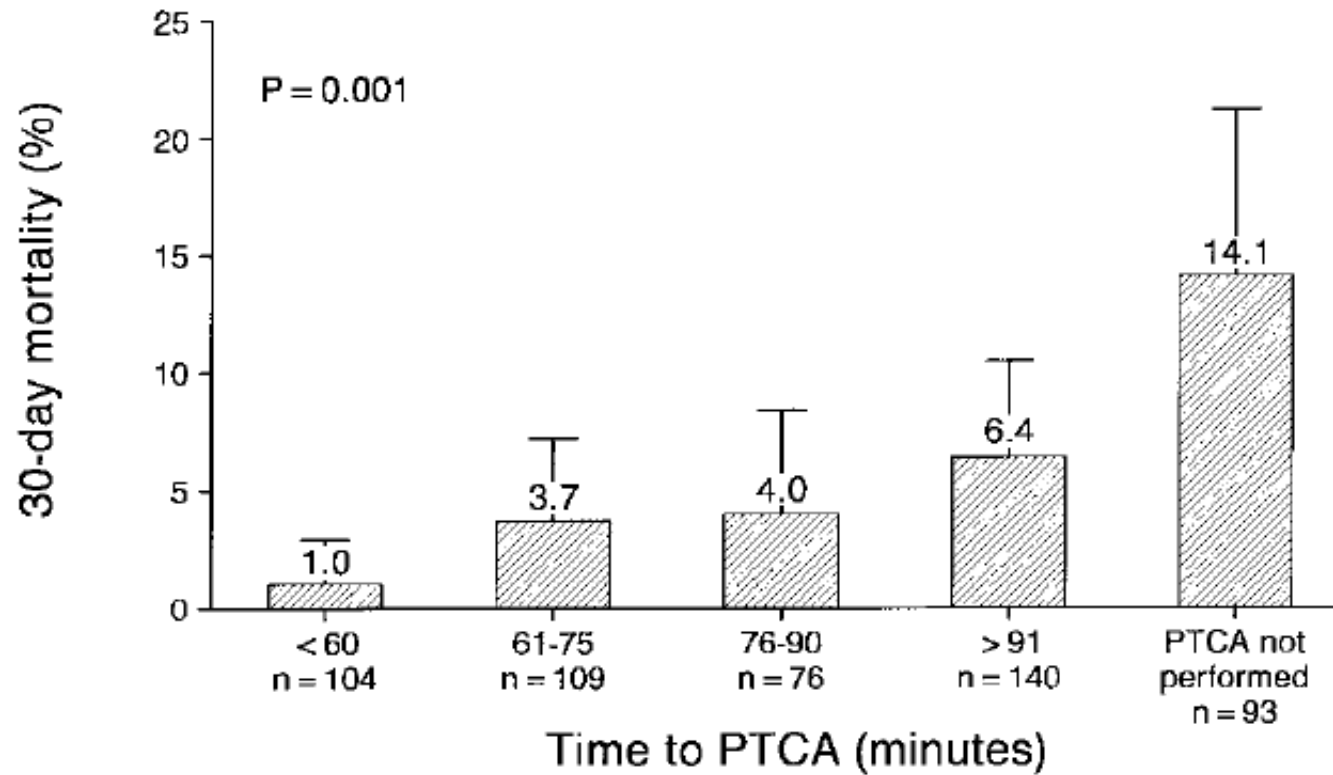
# STEMI



# EKG- Infarkt Stadien



## Time to PCI and mortality



Berger PB, et al. Circulation.100: 14-20 (1999)

# Reperfusion bei STEMI – dringlich!!!

Wichtigstes Ziel in der Infarktbehandlung

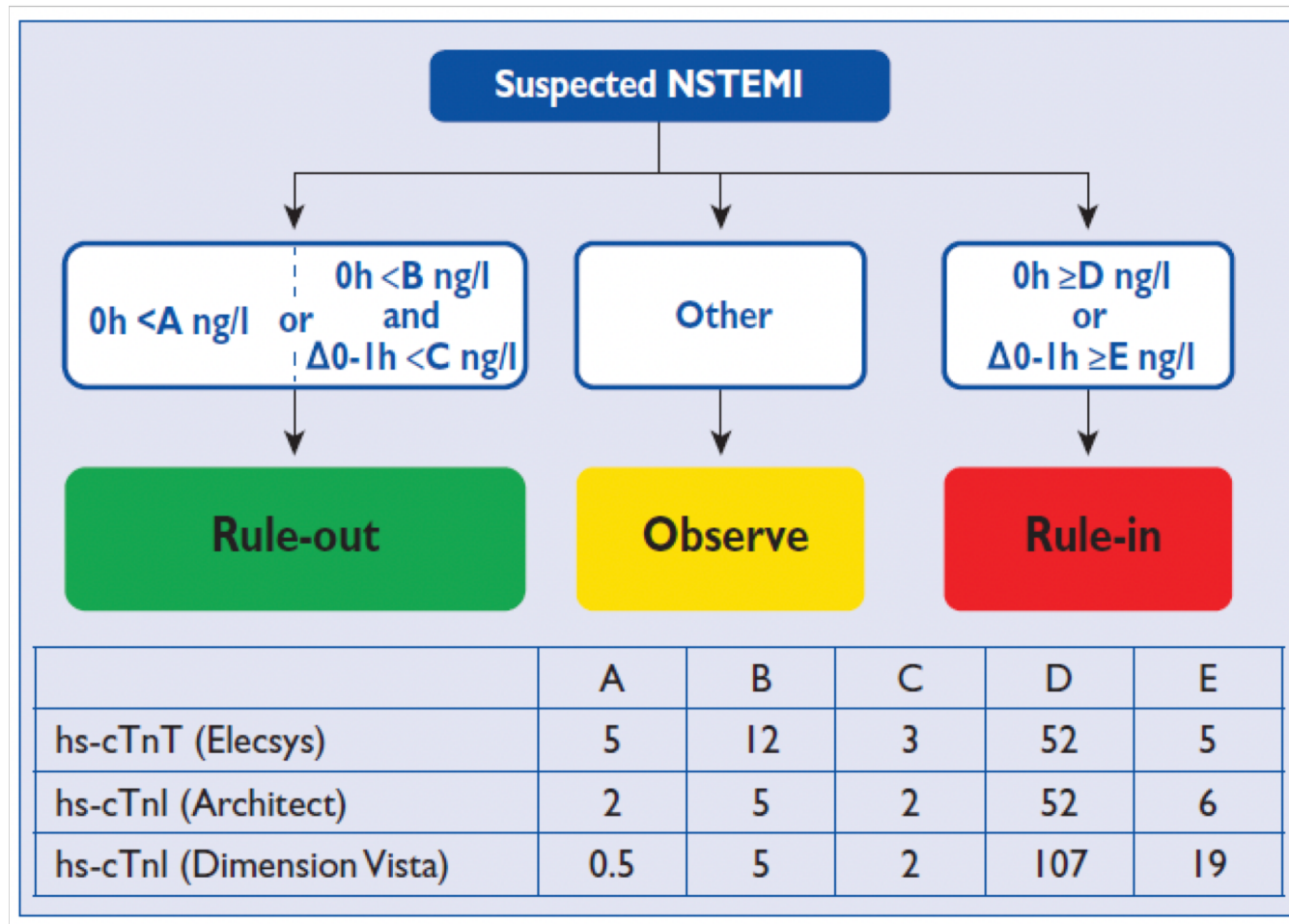
*Frühe,  
komplette  
und anhaltende Reperfusion des Myokards*

***„time is life, time is muscle“***



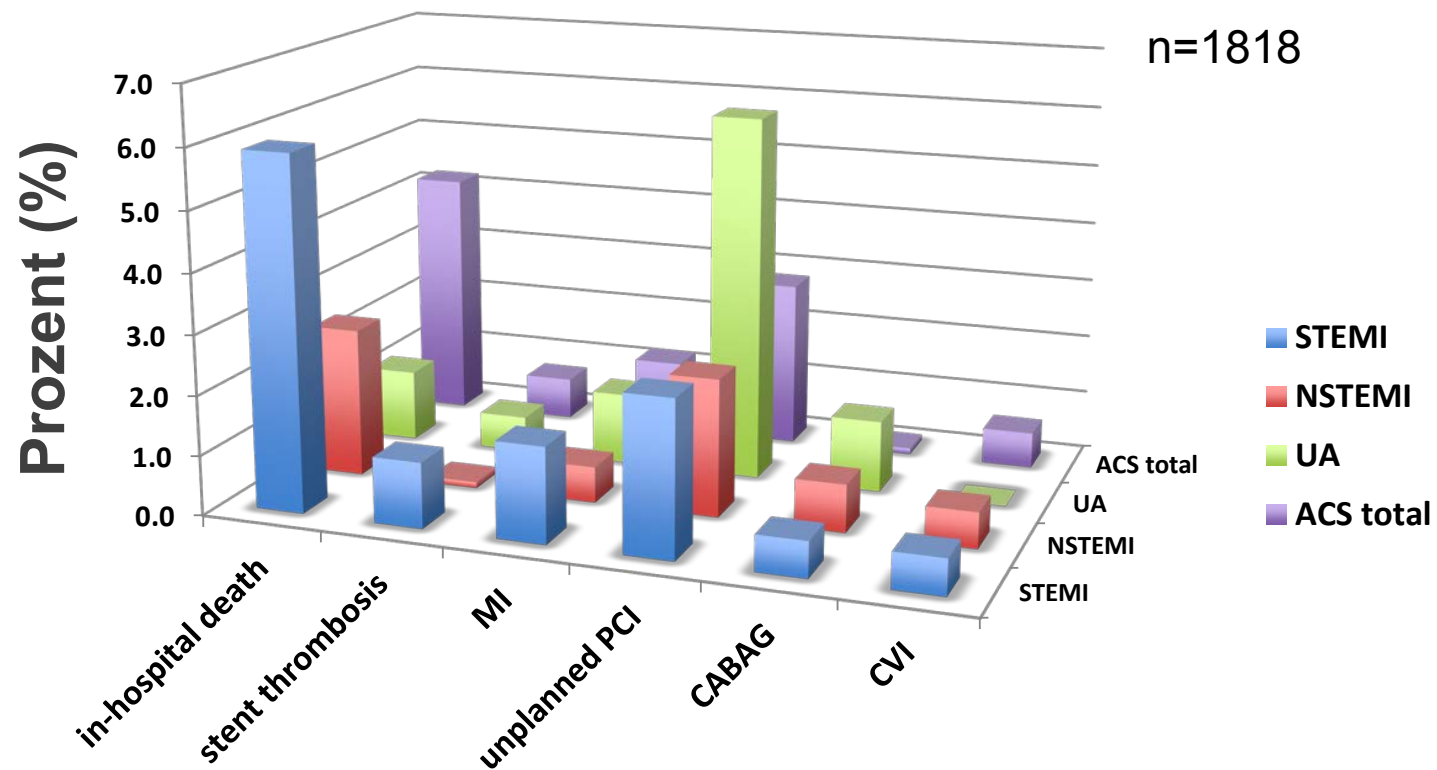
# Verdacht auf NSTEMI

## Diagnose mittels Biomarker 0/1h Algorithmus





# Outcome nach ACS

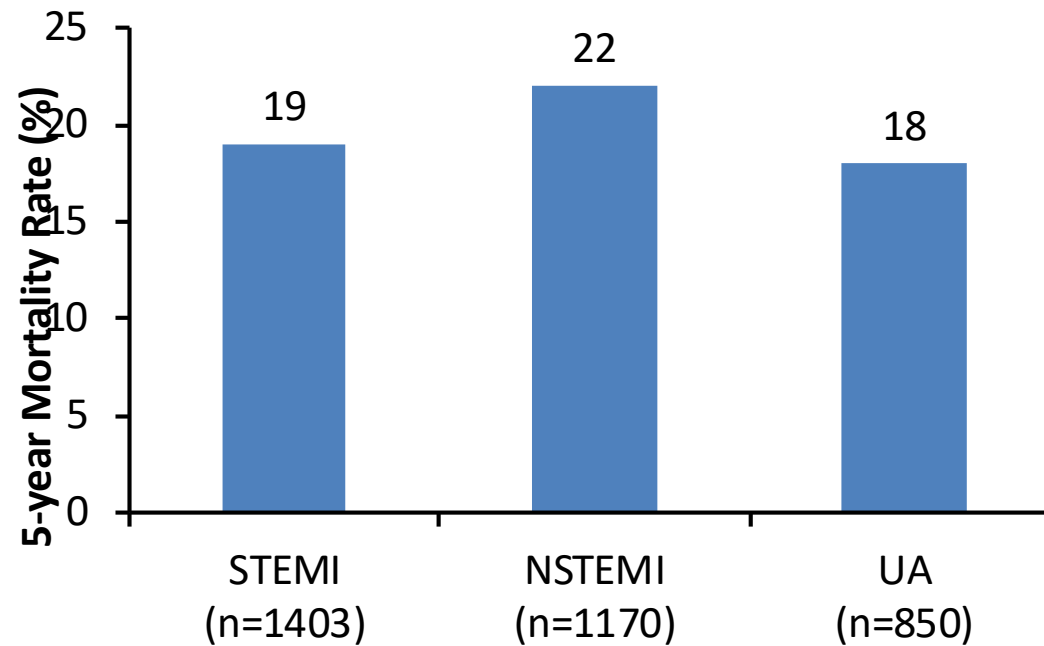


Z-ACS Registry  
2007-2010

# 5-Jahresmortalität nach ACS bleibt hoch

GRACE registry:

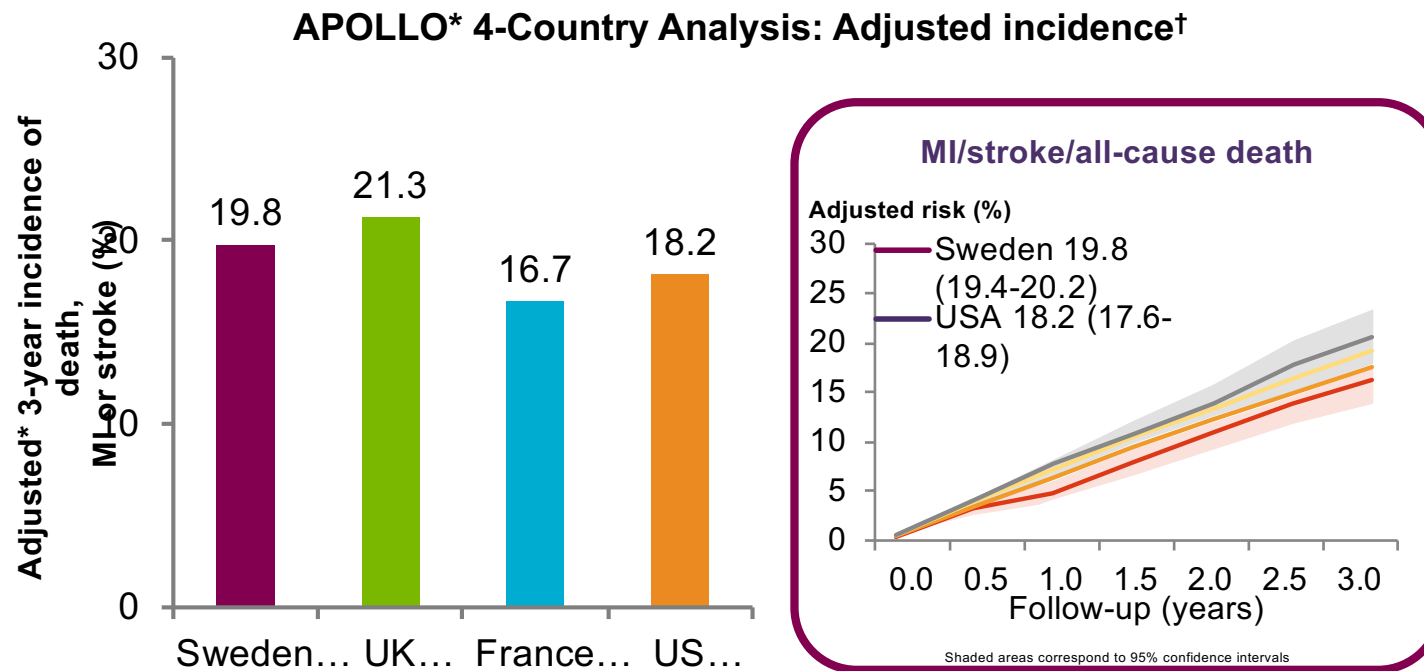
Analysis of patients in the UK and Belgium with ACS



ACS=acute coronary syndromes; GRACE=Global Registry of Acute Coronary Events; UA=unstable angina.

Fox AA et al. Underestimated and under-recognized: the late consequences of acute coronary syndrome (GRACE UK-Belgian Study). Eur Heart J. 2010;31:2755-2764  
Mozaffarian D et al. Heart disease and stroke statistics--2015 update: a report from the American Heart Association. Circulation. 2015 Jan 27;131(4):e29-322.

# Hohes CV Risiko auch nach ereignisfreiem ersten Jahr



\* >150,000 patients.

†Adjusted for differences in study populations. Shaded areas near color lines and figures in brackets represent 95% confidence interval.

Hemingway H. Presentation at ESC congress 2014. Slides available: <http://congress365.escardio.org/Search-Results?vnextkeyword=hemingway> (last checked 04.12.2014)

Rapsomaniki E et al. Prognostic models for stable coronary artery disease based on electronic health record cohort of 102 023 patients. [Eur Heart J. 2014 Apr;35\(13\):844-52.](#)

# Besten Dank für Ihre Aufmerksamkeit!

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