ACUUT CORONAIR SYNDROOM

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Tomas Symersky, cardioloog
Febr 2015

Diagnostiek

- Definitie
- Aantallen/statistiek
- Pathofysiologie

Diagnostiek - 2

- Anamnese

- Voorgeschiedenis

- Lichamelijk onderzoek

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Diagnostiek - 3

- ECG
- Biomarkers
- Beeldvorming

Diagnostiek - 4

- Risico scores
  - TIMI
  - Pursuit
  - GRACE
  - Heart Score

Definitie

- Spectrum van ischemische myocard aandoeningen
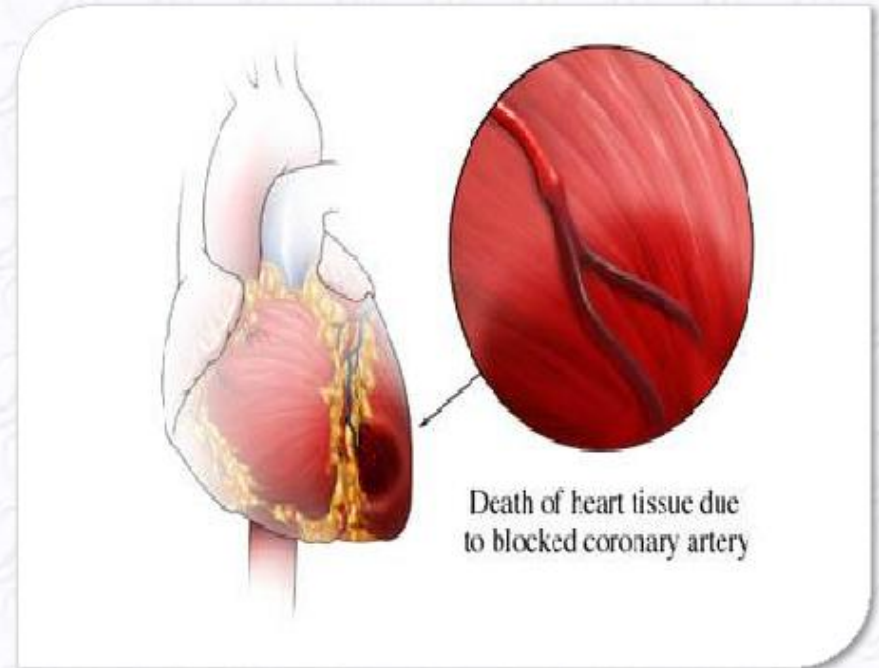- Coronaire atherosclerose met stollingsactivatie

Definitie

- STEMI
- Non-STEMI
- Instabiele angina pectoris

Definition of Myocardial Infarction

Pathology

Acute myocardial infarction is defined as myocardial cell death due to prolonged myocardial ischemia.

Death of heart tissue due to blocked coronary artery

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EXPERT CONSENSUS DOCUMENT

Third universal definition of myocardial infarction

Kristian Thygesen, Joseph S. Alpert, Allan S. Jaffe, Maarten L. Simoons, Bernard R. Chaitman and Harvey D. White: the Writing Group on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of Myocardial Infarction
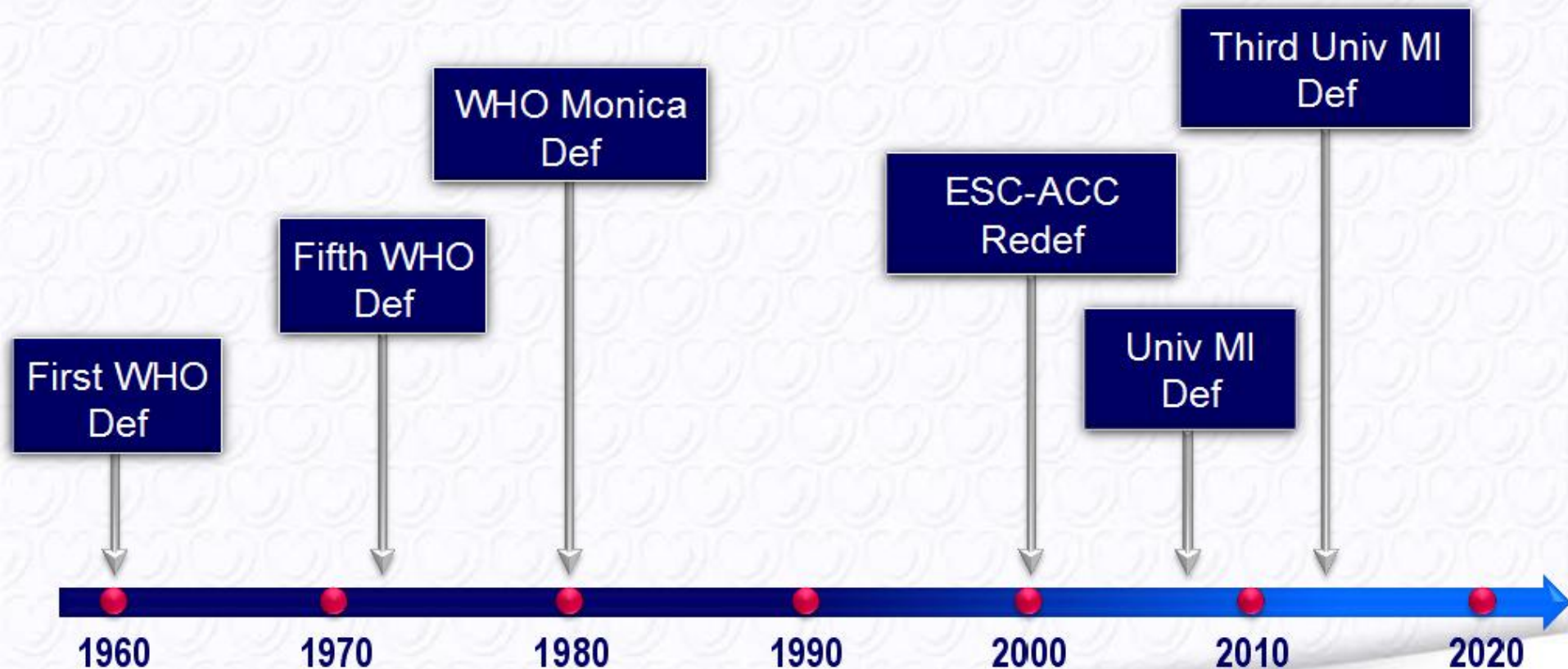
Authors/Task Force Members Chairpersons: Kristian Thygesen(Denmark)*, Joseph S. Alpert, (USA)*, Harvey D. White, (New Zealand)*, Biomarker.

Subcommittee: Allan S. Jaffe (USA), Hugo A. Katus (Germany), Fred S. Apple (USA), Bertil Lindahl (Sweden), David A. Morrow (USA), **ECG Subcommittee**: Bernard R. Chaitman (USA), Peter M. Clemmensen (Denmark), Per Johanson (Sweden), Hanoch Hod (Israel), **Imaging Subcommittee**: Richard Underwood (UK), Jeroen J. Bax (The Netherlands), Robert O. Bonow (USA), Fausto Pinto (Portugal), Raymond J. Gibbons (USA), **Classification Subcommittee**: Keith A. Fox (UK), Dan Atar (Norway), L. Kristin Newby (USA), Marcello Galvani (Italy), Christian W. Hamm (Germany), **Intervention Subcommittee**: Barry F. Uretsky (USA), Ph. Gabriel Steg (France), William Wijns (Belgium), Jean-Pierre Bassand (France), Phillippe Menasche (France), Jan Ravkilde (Denmark), **Trials & Registries Subcommittee**: E. Magnus Ohman (USA), Elliott M. Antman (USA), Lars C. Wallentin (Sweden), Paul W. Armstrong (Canada), Maarten L. Simoons (The Netherlands), **Heart Failure Subcommittee**: James L. Januzzi (USA), Markku S. Nieminen (Finland), Mihai Gheorghiade (USA), Gerasimos Filippatos (Greece), **Epidemiology Subcommittee**: Russell V. Luepker (USA), Stephen P. Fortmann (USA), Wayne D. Rosamond (USA), Dan Levy (USA), David Wood (UK), **Global Perspective Subcommittee**: Sidney C. Smith (USA), Dayi Hu (China), Jose-Luis Lopez-Sendon (Spain), Rose Marie Robertson (USA), Douglas Weaver (USA), Michal Tendera (Poland), Alfred A. Bove (USA), Alexander N. Parkhomenko (Ukraine), Elena J. Vasilieva (Russia), Shanti Mendis (Switzerland).

Changing Criteria for Definition of Myocardial Infarction
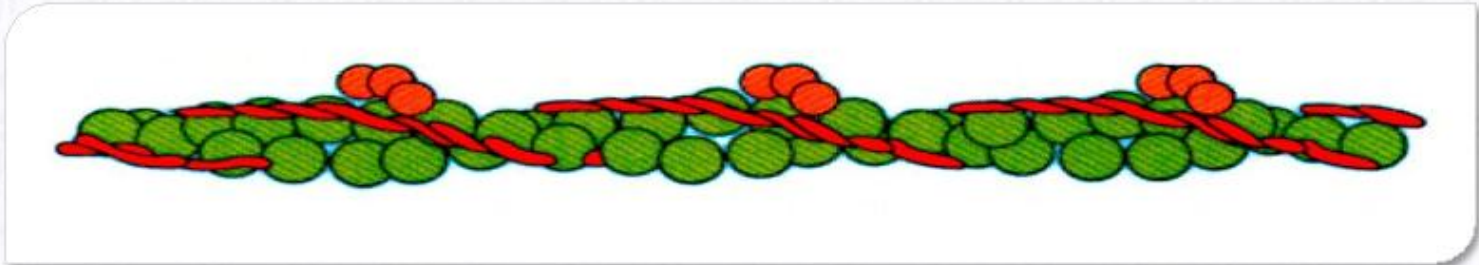
Primarily ECG approach

Primarily Biomarker Approach

Third Univ MI Def

WHO Monica Def

Fifth WHO Def

ESC-ACC Redef

First WHO Def

Univ MI Def

1960 1970 1980 1990 2000 2010 2020

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Criteria for Acute Myocardial Infarction

- **Detection of a rise and/or fall of cardiac biomarker values (preferably cardiac troponin) with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following:**

  - Ischaemic symptoms;

  - ECG changes of new ischaemia (new ST-T changes or new LBBB);

  - Development of pathologic Q waves in the ECG;

  - Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality;

  - Identification of an intracoronary thrombus by angiography or autopsy.

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Biomarkers for Detection of Myocardial Infarction

- **Preferably**
  - Detection of rise and/or fall of cardiac Troponin (I or T) with at least one value above the 99th percentile of the upper reference limit measured with a coefficient of variation ≤ 10%.

- **When cardiac Troponin is not available**
  - Detection of rise and/or fall of CKMB mass with at least one value above the 99th percentile of the upper reference limit measured with a coefficient of variation ≤ 10%.

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Elevations of Cardiac Troponin Values because of Myocardial Injury

- Injury related to primary myocardial ischemia (MI type 1).

- Injury related to supply/demand imbalance of myocardial ischaemia (MI type 2).

- Injury not related to myocardial ischaemia.

- Multifactorial or indeterminate myocardial injury.

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Elevations of Cardiac Troponin Values because of Myocardial Injury

Injury related to primary myocardial ischaemia

- Plaque rupture.
- Intraluminal coronary artery thrombus formation.

Injury related to supply/demand imbalance of myocardial ischaemia

- Tachy-/brady-arrhythmias.
- Aortic dissection or severe aortic valve disease.
- Hypertrophic cardiomyopathy.
- Cardiogenic, hypovolaemic, or septic shock.
- Severe respiratory failure.
- Severe anaemia.
- Hypertension with or without LVH.
- Coronary spasm.
- Coronary embolism or vasculitis.
- Coronary endothelial dysfunction without significant CAD.

Injury not related to myocardial ischaemia

- Cardiac contusion, surgery, ablation, pacing, or defibrillator shocks.
- Rhabdomyolysis with cardiac involvement.
- Myocarditis.
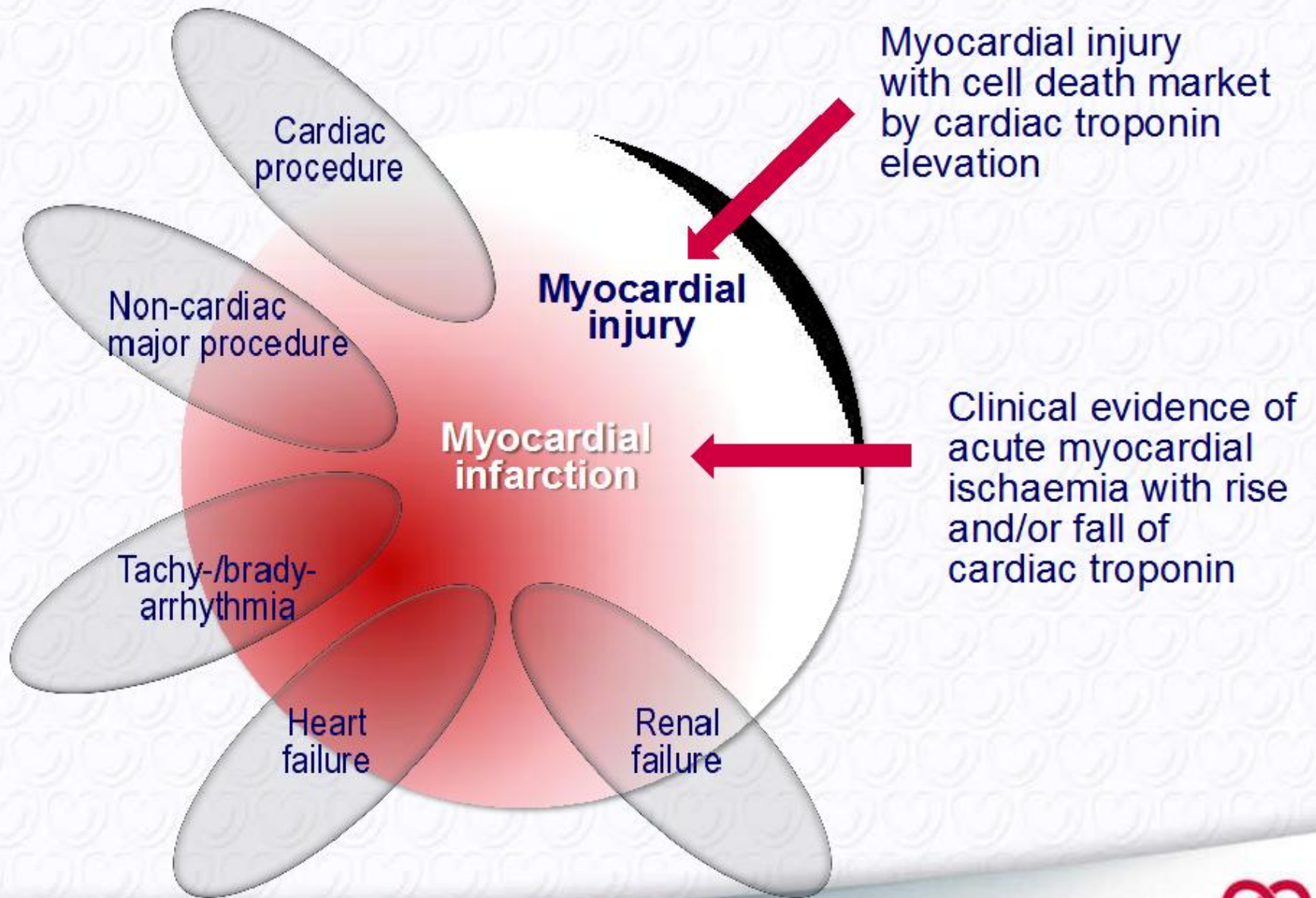- Cardiotoxic agents, e.g. anthracyclines, herceptin.

Multifactorial or indeterminate myocardial injury

- Heart failure.
- Stress (Takotsubo) cardiomyopathy.
- Severe pulmonary embolism or pulmonary hypertension.
- Sepsis and critically ill patients.
- Renal failure.
- Severe acute neurological diseases, e.g. stroke, subarachnoid haemorrhage.
- Infiltrative diseases, e.g. amyloidosis, sarcoidosis.
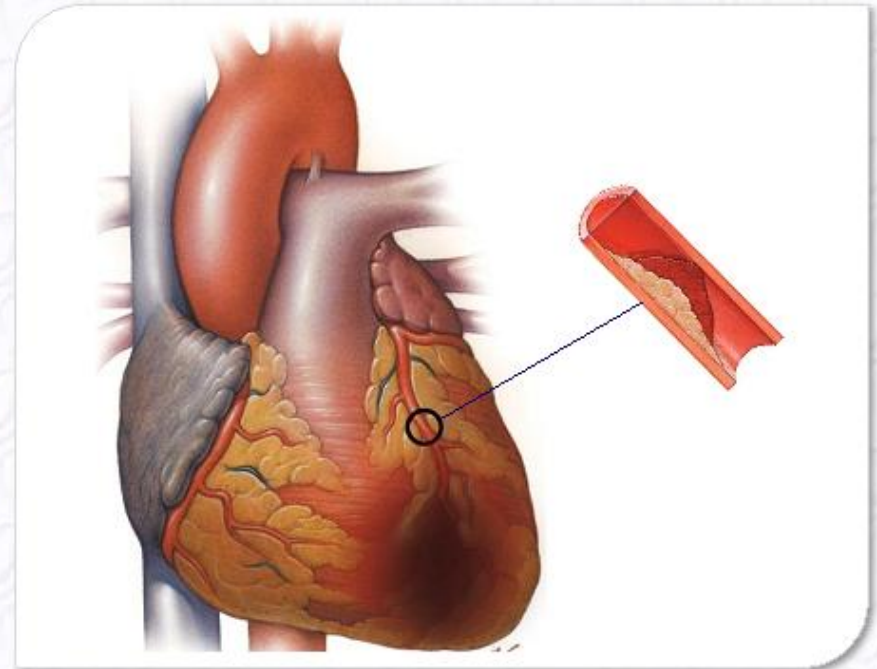- Strenuous exercise.

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Troponin elevation
Possible non-acute coronary syndrome causes

- **Chronic or acute renal dysfunction.**
- Severe congestive **heart failure** - acute and chronic.
- **Hypertensive crisis.**
- **Tachy- or bradyarrhythmias.**
- **Pulmonary embolism,** severe pulmonary hypertension.
- Inflammatory diseases, e.g. **myocarditis**.
- Acute neurological disease, including **stroke**, or subarachnoid haemorrhage.
- Aortic dissection, aortic valve disease or hypertrophic cardiomyopathy.
- Cardiac contusion, ablation, pacing, cardioversion, or endomyocardial biopsy.
- Hypothyroidism.
- Apical ballooning syndrome (Tako-Tsubo cardiomyopathy).
- Infiltrative diseases, e.g. amyloidosis, haemochromatosis, sarcoidosis, sclerodermia.
- Drug toxicity, e.g. adriamycin, 5-fluorouracil, herceptin, snake venoms.
- Burns, if affecting > 30% of body surface area.
- Rhabdomyolysis.
- Critically ill patients, especially with respiratory failure, or sepsis.
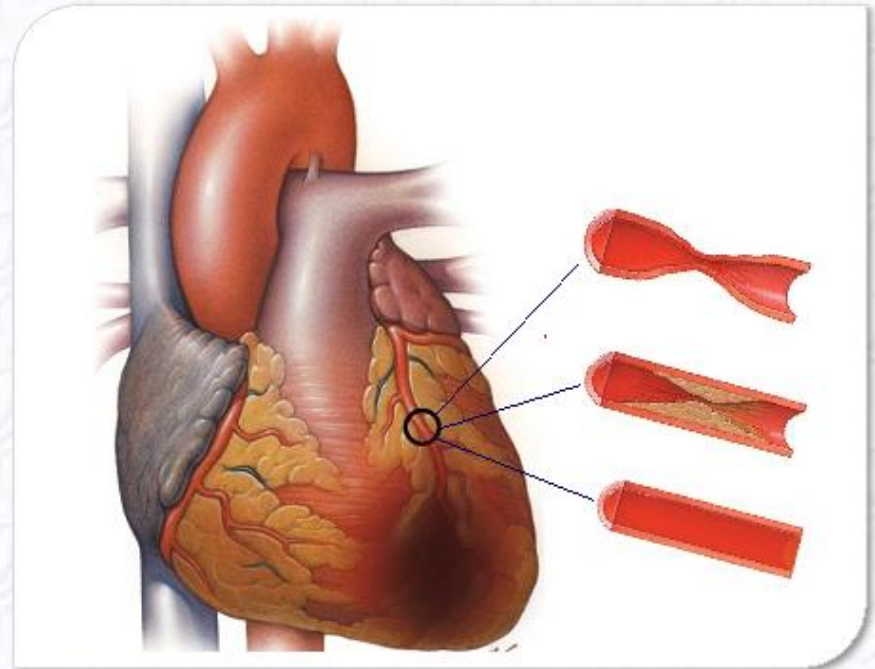
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Cardiac
procedure

Non-cardiac
major procedure

Tachy-/brady-
arrhythmia

Heart
failure

Renal
failure

**Myocardial
injury**

**Myocardial
infarction**

Myocardial injury
with cell death market
by cardiac troponin
elevation

Clinical evidence of
acute myocardial
ischaemia with rise
and/or fall of
cardiac troponin

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Myocardial Infarction Type 1

Spontaneous myocardial infarction related to **atherosclerotic plaque** rupture, ulceration, fissuring, erosion, or dissection with resulting intraluminal thrombus in one or more 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.
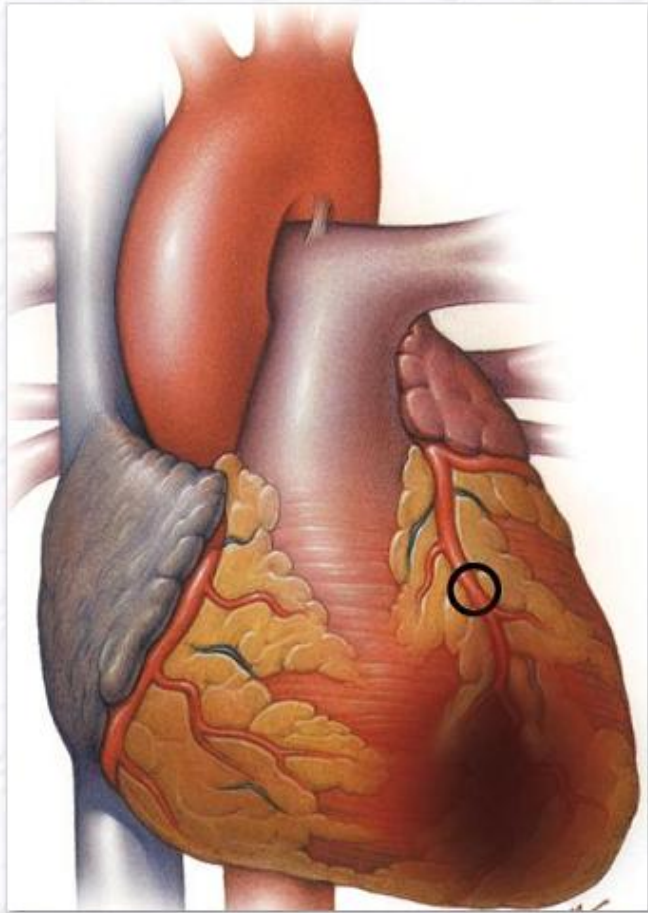
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Myocardial Infarction Type 2

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-arrhythmia, anaemia, respiratory failure, hypotension or hypertension with and without LVH.

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Differentiation between MI Types 1 and 2 according to the Condition of the Coronary Arteries

Plaque rupture with thrombus
MI Type 1

Vasospasm or endothelial dysfunction
MI Type 2

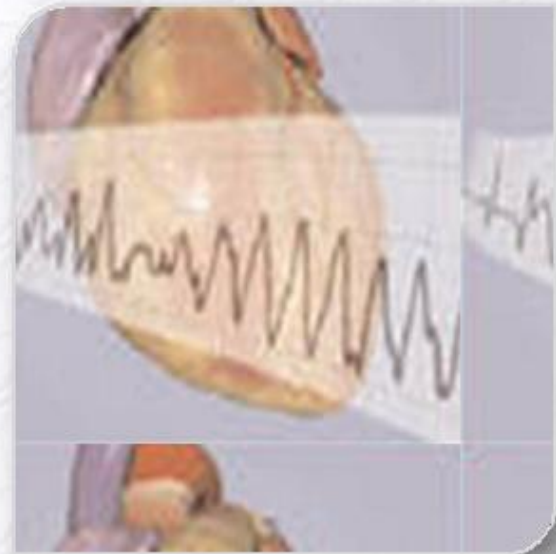Fixed atherosclerosis and supply-demand imbalance
MI Type 2

Supply-demand imbalance alone
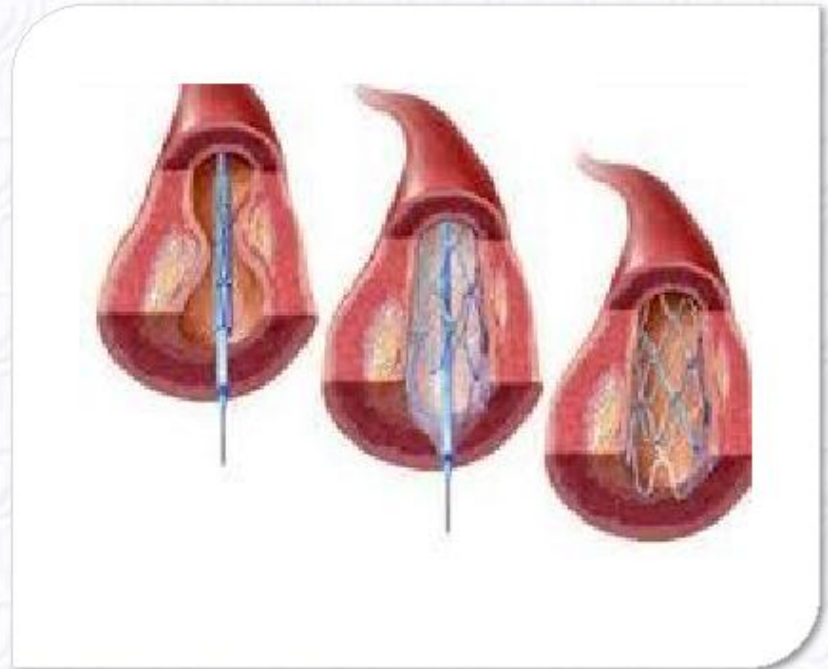**MI Type 2**

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Myocardial Infarction Type 3

Cardiac death with symptoms suggestive of myocardial ischaemia and presumed new ischaemic ECG changes or new LBBB, but death occurring before blood samples could be obtained, before cardiac biomarkers could rise, or in rare cases cardiac biomarkers were not collected.
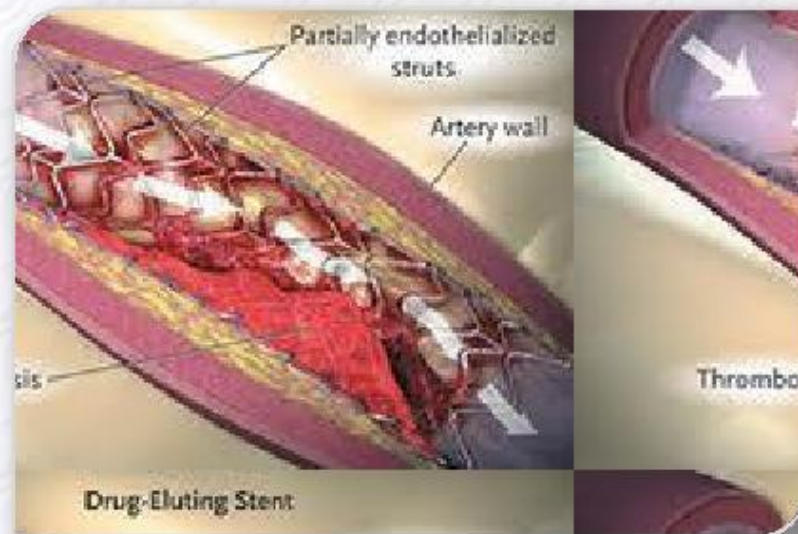
Myocardial Infarction Type 4a

Myocardial infarction associated with PCI is arbitrarily defined by elevation of cTn values > 5 X 99th percentile URL in patients with normal baseline (≤ 99th percentile URL) or rise of cTn values > 20% if the baseline values are elevated and stable or falling. In addition, either (i) symptoms suggestive of myocardial ischaemia or (ii) new ischaemic ECG changes or new LBBB, or (iii) angiographic finding of a procedural complication or (iv) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality are required.
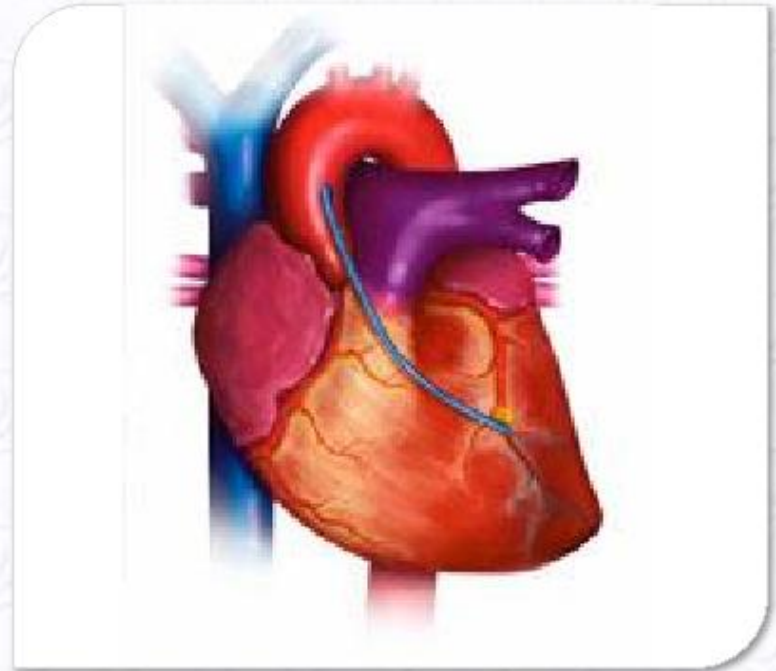
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Myocardial Infarction Type 4b

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 biomarkers with at least one value > 99th percentile URL.

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Myocardial Infarction Type 5

Myocardial infarction associated with CABG is arbitrarily defined by elevation of cTn values > 10 x 99th percentile URL in patients with normal baseline ($\leq$ 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.

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Criteria for ST Segment Elevation

New ST elevation at the J point in 2 contiguous leads with the following cut-points:

- ≥ 0.1 mV in all leads except leads V_2-V_3 in men and women;

- In leads V_2-V_3, ≥ 0.2 mV in men ≥ 40 years and ≥ 0.25 mV in men < 40 years;

- In leads V_2-V_3, ≥ 0.15 mV in women.

Age and gender specific

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Criteria for Non-ST Segment Elevation

New horizontal or down-sloping
ST segment depression ≥ 0.05 mV
in 2 contiguous leads,

or

T inversion ≥ 0.1 mV in 2 contiguous
leads with prominent R wave or
R/S ratio > 1.

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Conditions that confound the ECG Diagnosis of Myocardial Infarction

Common ECG pitfalls in diagnosing myocardial infarction

False positives	
• Early repolarization	• Metabolic disturbances such as hyperkalaemia
• LBBB	• Cardiomyopathy
• Pre-excitation	• Lead transposition
• J point elevation syndromes, e.g. Brugada syndrome	• Cholecystitis
• Peri-/myocarditis	• Persistent juvenile pattern
• Pulmonary embolism	• Malposition of precordial ECG electrodes
• Subarachnoid haemorrhage	• Tricyclic antidepressants or phenothiazines

False negatives
• Prior MI with Q-waves and/or persistent ST elevation
• Right ventricular pacing
• LBBB

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Enkele feiten

Sterfte in NL

- 50,000 HVZ
- 11,000 SCD meeste hartinfarct
- 36,000 hartinfarct – 25% overlijden pre-hospitaal
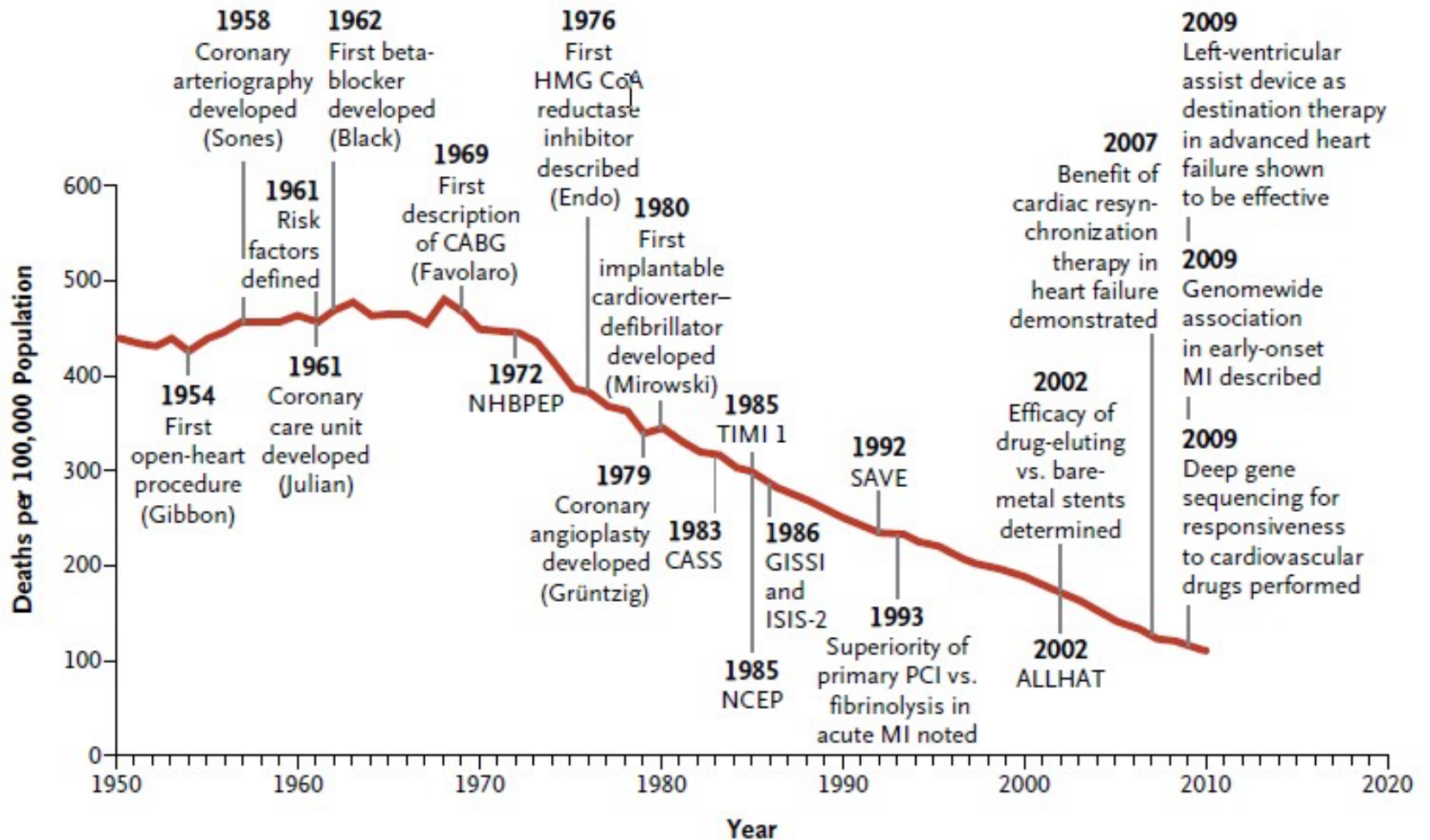- Ziekenhuissterfte circa 4-6%
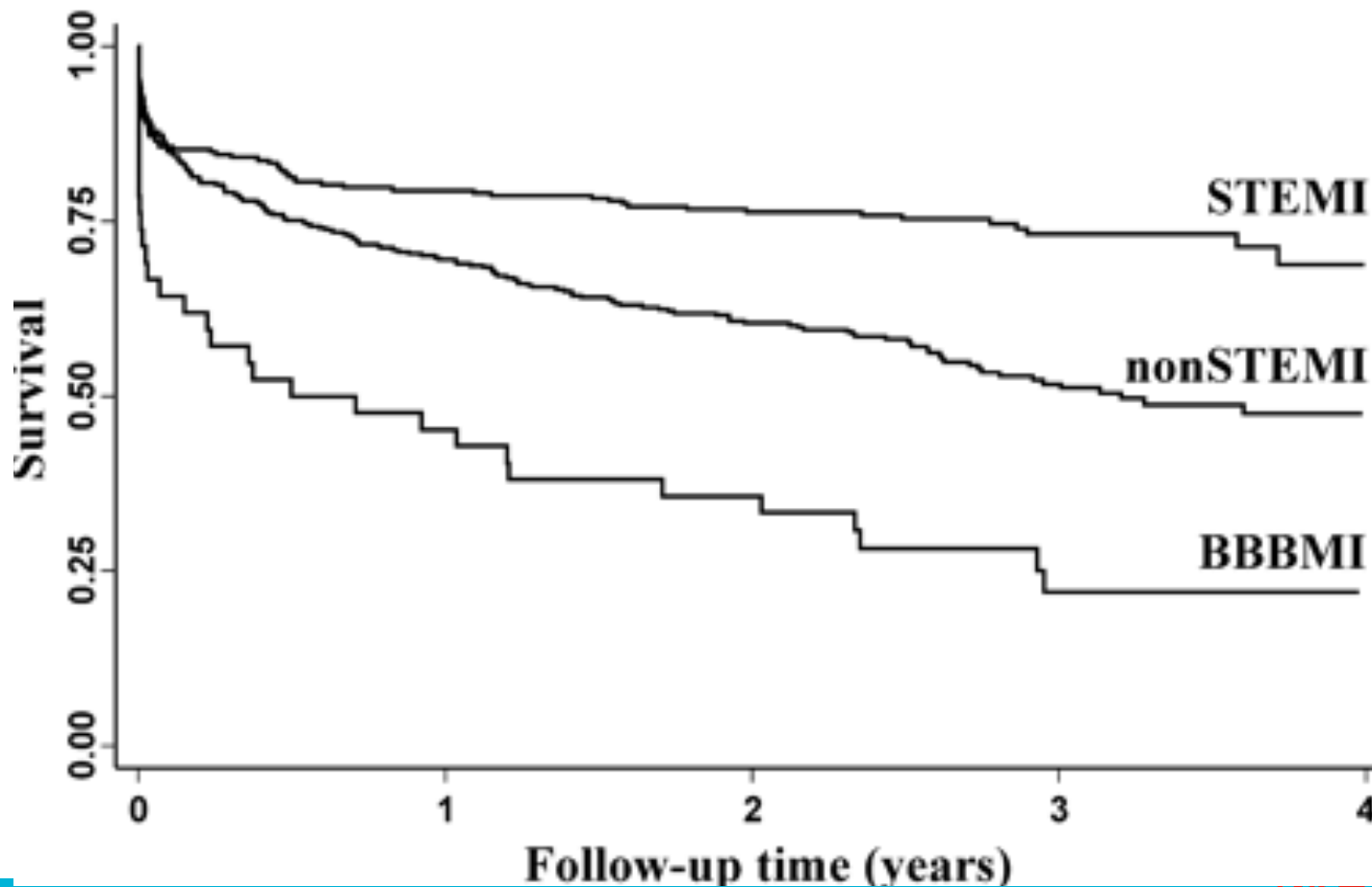
Incidentie ACS in Europa

Figure 1. Decline in Deaths from Cardiovascular Disease in Relation to Scientific Advances.

Prognose

Sterfte STEMI vs. nonSTEMI

- In hospital   7% vs 5%
- 6 maanden   12% vs 13%
- 4 jaars   ?

Sterfte

Waarom?

- Ouder
- Multivessel
- Comorbiditeit
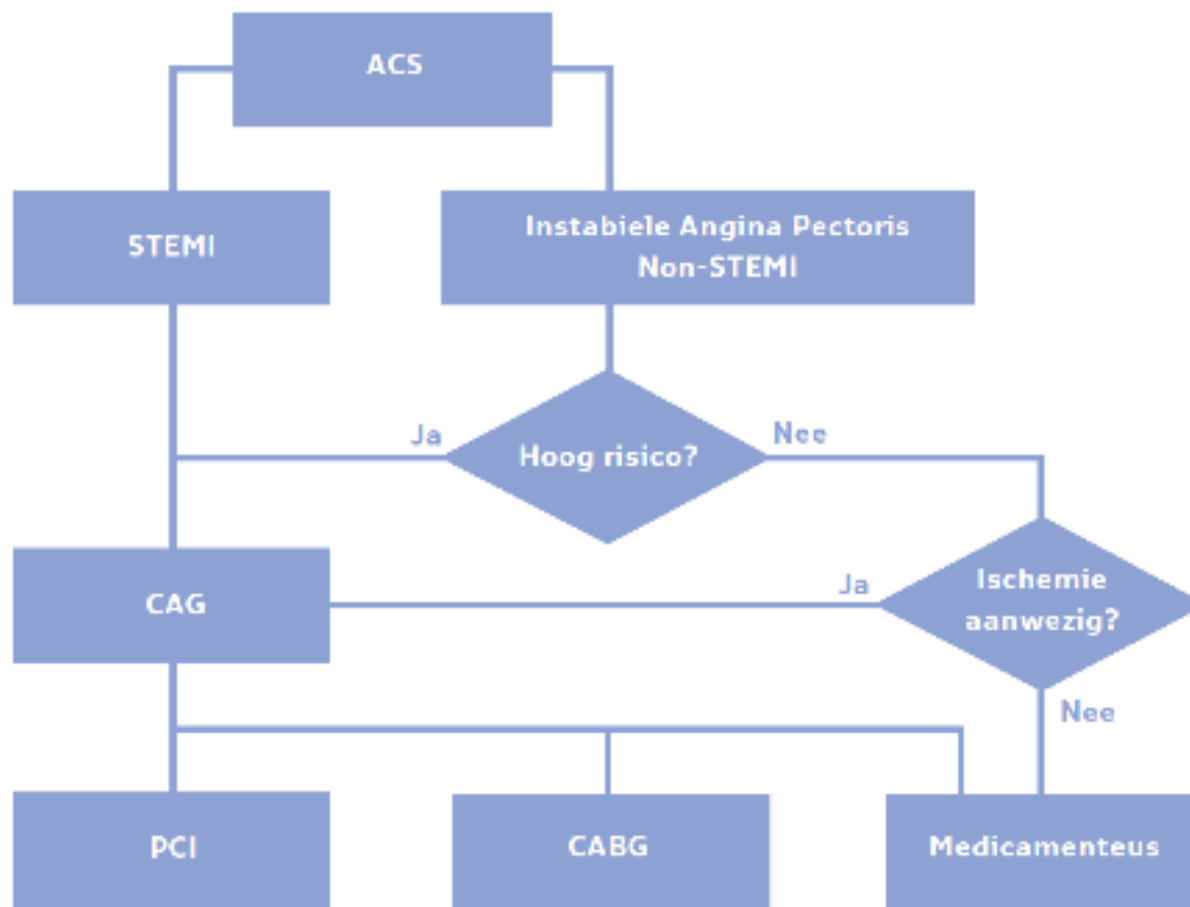- Meer diabetes
- Meer vrouwen
- En…

Posterior infarct

- 50% van de infarcten tgv een volledige occlusie van de CX komt met een niet-diagnostisch ECG
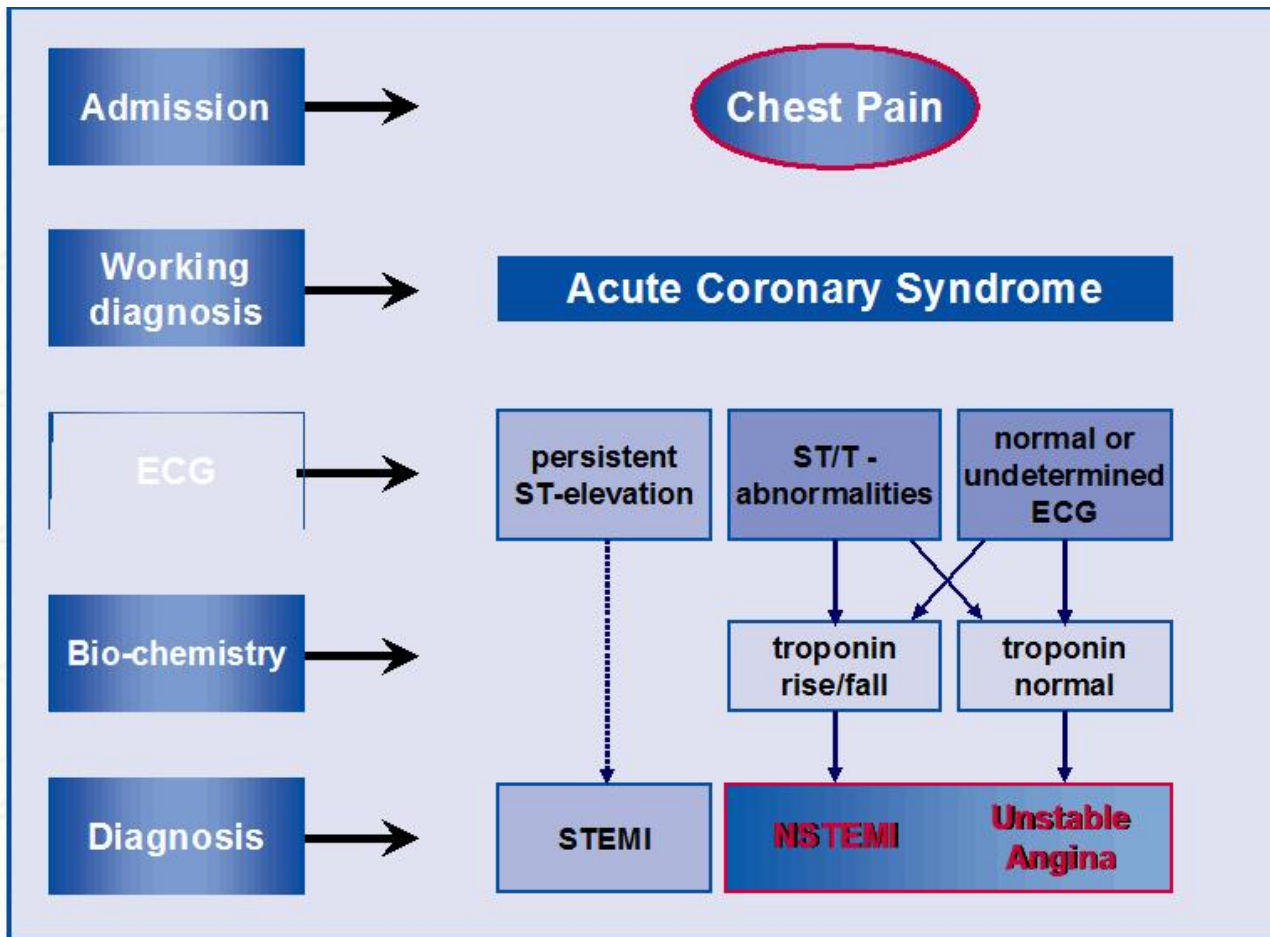
Bron: Rasoul et al. Hartinfarct zonder ecg-afwijkingen. NtvG 2012.

What is new?

- **Diagnostic**
  - High-sensitive troponin introduced
  - Echocardiography standard
  - Coronary CT for rule-out in low/intermediate risk patients

- **Risk Stratification**
  - 3-hour fast rule-out protocol
  - Bleeding risk score (CRUSADE)

- **Medical Treatment**
  - Ticagrelor and prasugrel introduced

- **Revascularization**
  - Timing of revascularization

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Beslisboom ACS

European Heart Journal (2011) 32:2999–3054

Rapid rule-out of ACS with high-sensitivity troponin

Acute Chest Pain

hsTn < ULN

hsTn > ULN

Pain > 6 h

Pain < 6 h

Re-test hsTn: 3 h

hsTn no change

Δ change (I value > ULN)

Highly abnormal Tn + clinical presentation

hsTn no change

Painfree, GRACE < 140, differential diagnoses excluded

Work-up differential diagnoses

Discharge/ Stress testing

Invasive management

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Risicoscore

- TIMI score
- PURSUIT score
- GRACE score
- Crusade bleeding score

TIMI score

- Age ≥ 65
- Aspirin use in the last 7 days
- > 2 angina episodes within the last 24hrs
- ST changes > 0.5mm in contiguous leads
- Elevated serum cardiac biomarkers
- Known Coronary Artery Disease (CAD) (coronary stenosis ≥ 50%)
- At least 3 risk factors for CAD, such as:

    Hypertension -> 140/90 or on anti-hypertensives

    Current cigarette smoker

    Low HDL cholesterol (< 40 mg/dL)

    Diabetes mellitus

    Family history of premature CAD

    - Male first-degree relative or father younger than 55
    - Female first-degree relative or mother younger than 65

% risk at 14 days of: all-cause mortality, new or recurrent MI, or severe recurrent ischemia requiring urgent revascularization.

- 0-1 = 4.7% risk
- 2 = 8.3% risk
- 3 = 13.2% risk
- 4 = 19.9% risk
- 5 = 26.2% risk
- 6-7 = at least 40.9% risk

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Global Registry of Acute Coronary Events

Assessing Today's Practice Patterns to Enhance Tomorrow's Care

What is GRACE?

Global Registry of Acute Coronary Events

- Largest multinational registry covering the full spectrum of ACS
- Generalizable patient inclusion criteria
- In-hospital and 6-month follow-up
- Representative of the catchment population: (clusters of hospitals)
- Full spectrum of hospitals and facilities
- Training, audit and quality control

Mortality in hospital and at 6 months according to the GRACE risk score

Risk category (tertile)	GRACE risk score	In-hospital death (%)
Low	≤ 108	< 1
Intermediate	109-140	1-3
High	> 140	> 3
Risk category (tertile)	GRACE risk score	Post- discharge to 6-month death (%)
Low	≤ 88	< 3
Intermediate	89-118	3-8
High	> 118	> 8

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Crusade bleeding score

CRUSADE score of in-Hospital major bleeding

Predictor	Score
Baseline haematocrit, %	
< 31	9
31-33.9	7
34-36.9	3
37-39.9	2
≥ 40	0
Creatinine clearance, mL/min	
≤ 15	39
> 15-30	35
> 30-60	28
> 60-90	17
> 90-120	7
> 120	0

Predictor	Score
Heart rate (b.p.m.)	
≤ 70	0
71-80	1
81-90	3
91-100	6
101-110	8
111-120	10
≥ 121	11
Male	0
Female	8
Sex	
Male	0
Female	8
Signs of CHF at presentation	
No	0
Yes	7

Predictor	Score
Prior vascular disease	
No	0
Yes	6
Diabetes mellitus	
No	0
Yes	6
Systolic blood pressure, mmHg	
≤ 90	10
91-100	8
101-120	5
121-180	1
181-200	3
≥ 201	5

www.crusadebleedingscore.org

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Crusade score

<21 very low
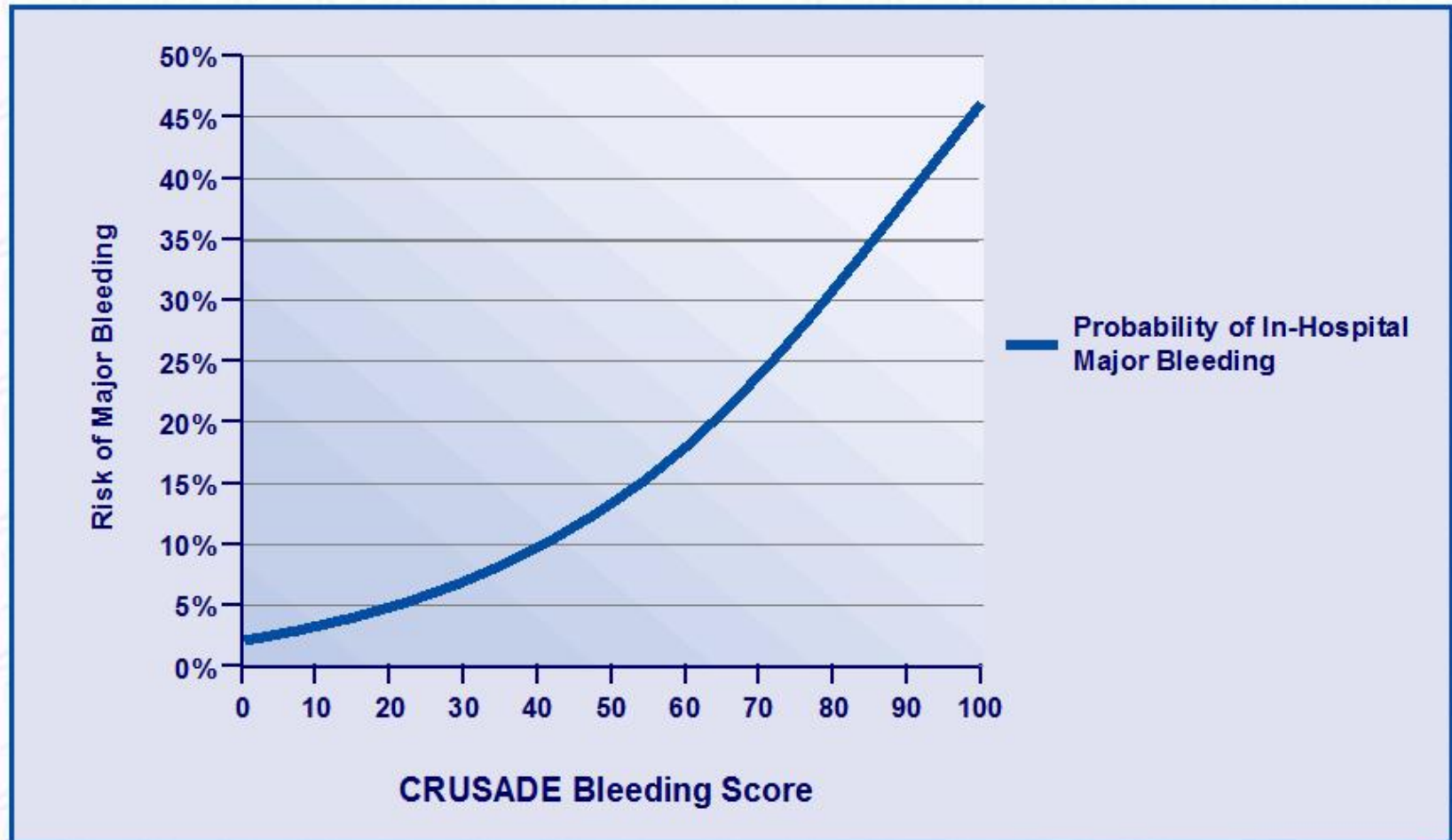
21-30 low

31-40 moderate

41-50 high

>50 very high

Risk of major bleeding across the spectrum of CRUSADE bleeding score

www.escardio.org/guidelines

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Timing

- Wat en wanneer

Aanbevelingen

- **Urgent** coronary angiography (<2 hours) is recommended in patients at very high ischaemic risk (refractory angina, with associated heart failure, cardiogenic shock, life-threatening ventricular arrhythmias, or haemodynamic instability).

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Aanbevelingen

- An **early** invasive strategy (<24 hours) is recommended in patients with at least one **primary** high-risk criterion.

Criteria for high risk with indication for invasive management

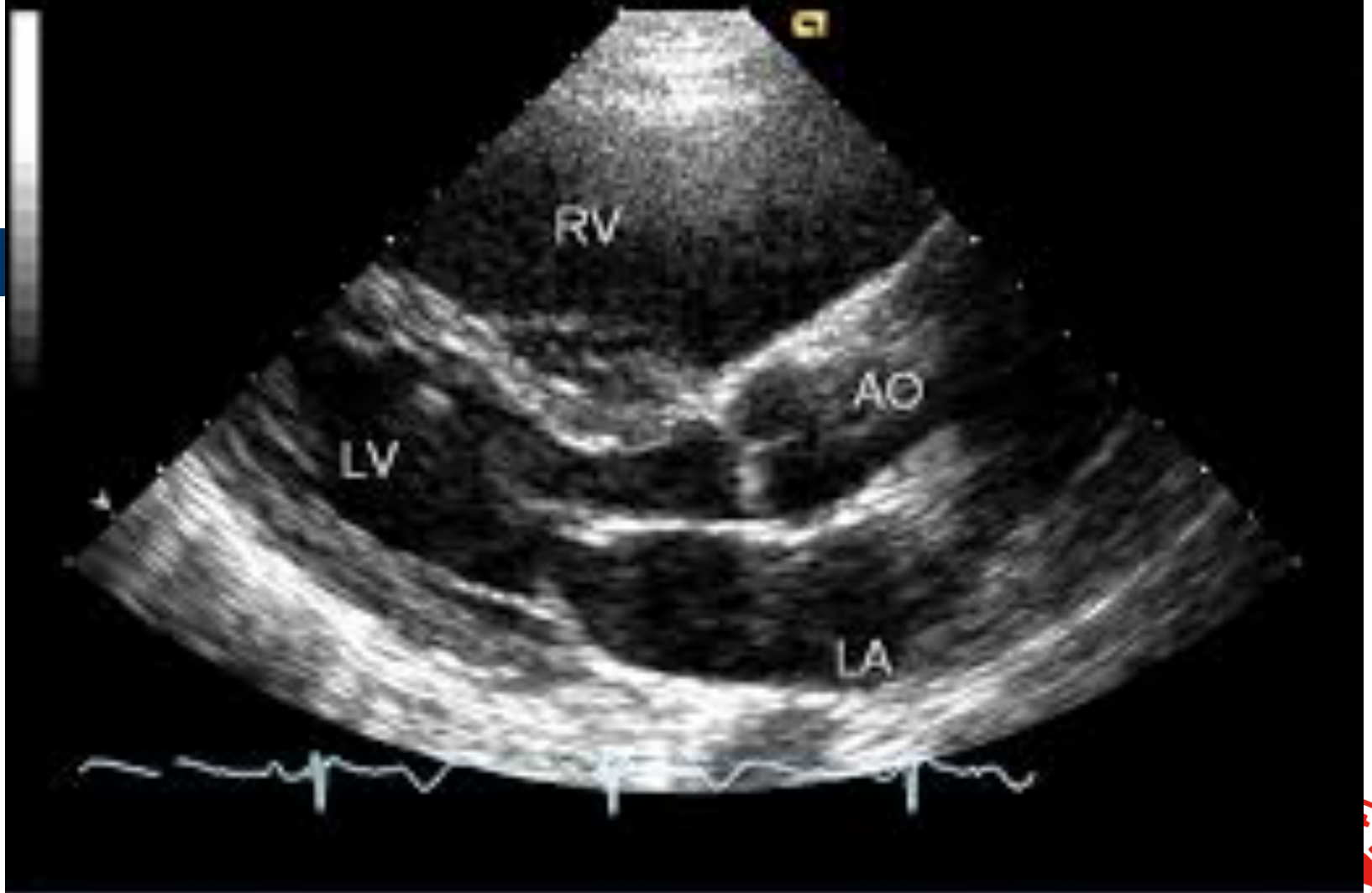| Primary |
|---|
| • Relevant rise or fall in troponin. |
| • Dynamic ST- or T-wave changes (symptomatic or silent). |

Secondary
• Diabetes mellitus.
• Renal insufficiency (eGFR < 60 mL/min/1.73 m^2).
• Reduced LV function (ejection fraction < 40%).
• Early post infarction angina.
• Recent PCI.
• Prior CABG.
• Intermediate to high GRACE risk score.

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Aanbevelingen

- An invasive strategy (<72 hours after first presentation) is indicated in patients with at least one high-risk criterion or recurrent symptoms.

Aanbevelingen

- Non-invasive documentation of inducible ischaemia is recommended in low-risk patients without recurrent symptoms before deciding on invasive evaluation.
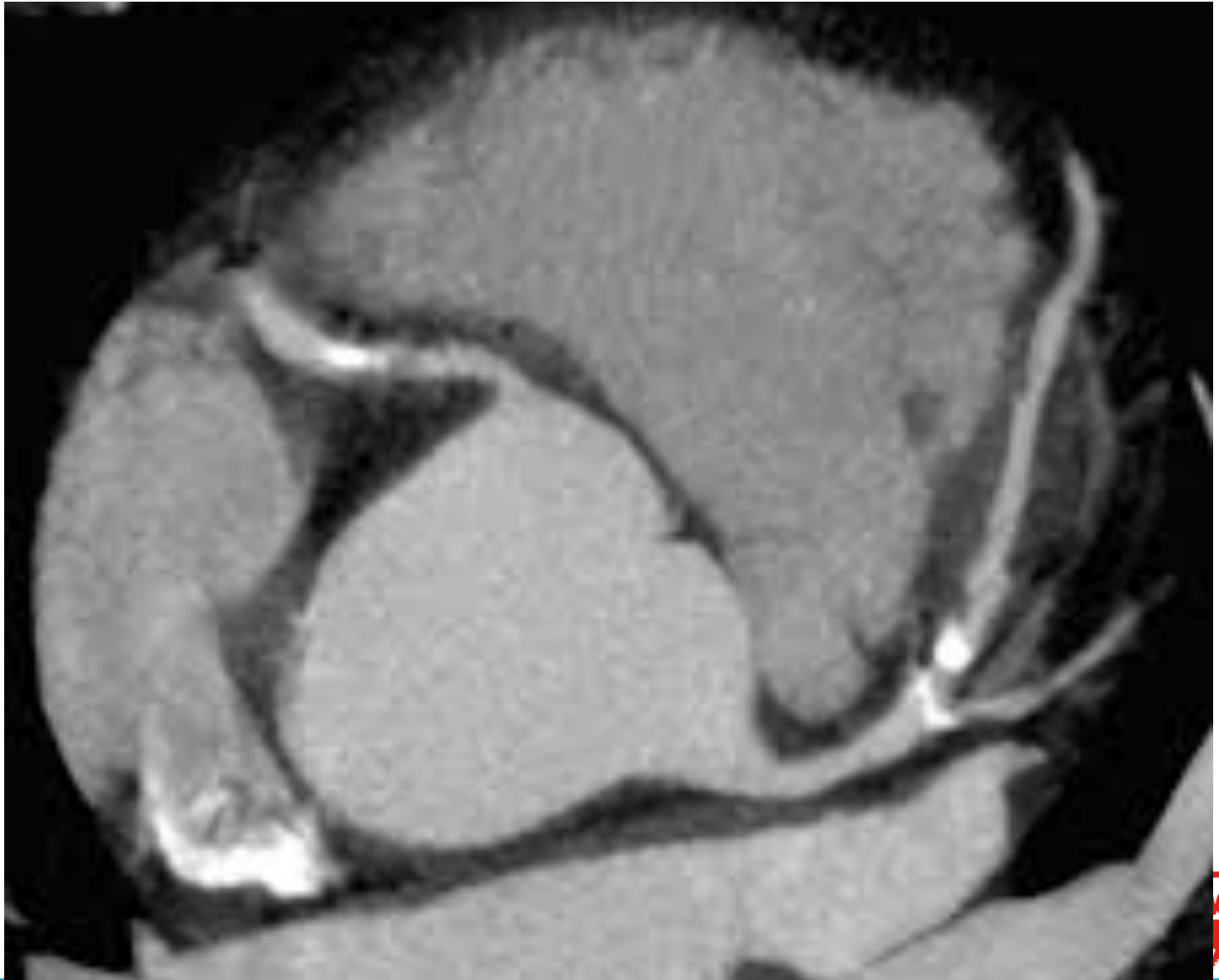
Alternatieven

- Calciumscore – score
- Myocardscintigrafie met stress (fiets/ adenosine)
- Combi - snelstraat
- *(Dobutamine stress echocardiografie)*
- *(MRI perfusie)*

Coronary Artery Calcium Scoring to Exclude Flow-Limiting Coronary Artery Disease in Symptomatic Stable Patients at Low or Intermediate Risk
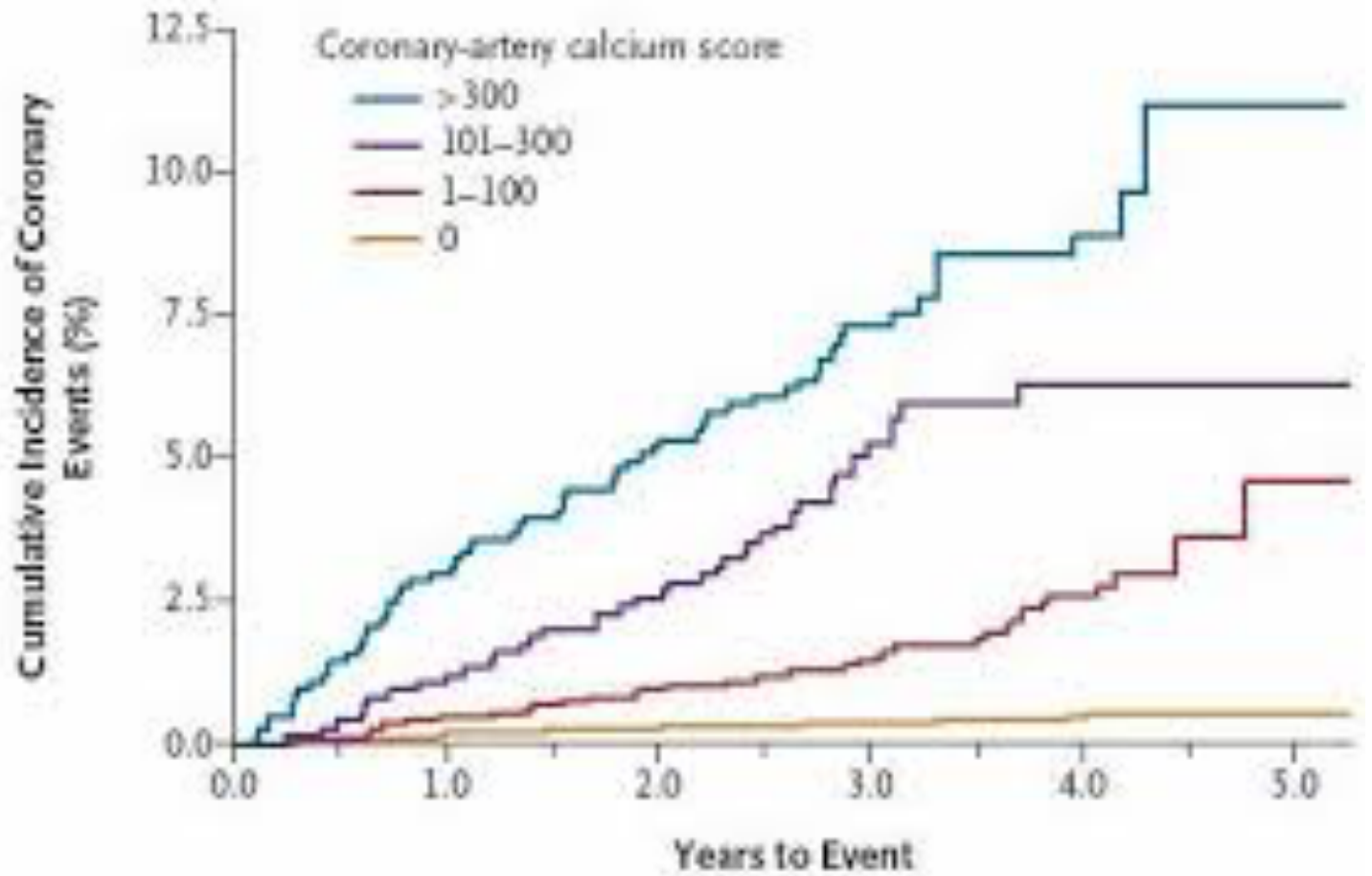
Mouden et al.

Purpose

To assess the capability of a zero coronary artery calcium (CAC) score to help exclude flow-limiting coronary artery disease (CAD) in a homogeneous population with stable anginal complaints and a low-to-intermediate pretest likelihood.

Materials and Methods

Between 2009 and 2011, a total of **3501** consecutive stable patients without known CAD underwent prospectively simultaneous myocardial perfusion imaging and CAC scoring on a hybrid, 64-section single photon emission computed tomography (SPECT)/computed tomography (CT) scanner. In 868 (25%) of 3501 patients, the CAC score was zero, and these patients constituted the current study population.

Conclusion

A CAC score of zero in stable patients at low or intermediate risk excludes flow-limiting CAD. These findings support the possibility of CAC scoring as a simple and safe tool to select patients for additional testing or discharge, as recommended in the literature.

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Coronary-artery calcium score
— >300
— 101–300
— 1–100
— 0

Samenvatting

1. Anamnese/VG
2. LO
3. ECG – inclusief V3-4 en V7-9
   serieel herhalen
4. Tropo's
5. Risico stratificatie

Samenvatting - 2

1. TTE
2. CAG +/- PCI
3. Calciumscore
4. CT- coronairen

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Recommendations for diagnosis and risk stratification (1)

Recommendations	Class	Level
In patients with a suspected NSTE-ACS, diagnosis and short-term ischaemic/bleeding risk stratification should be based on a combination of clinical history, symptoms, physical findings, ECG (repeated or continuous ST monitoring), and biomarkers.	I	A
ACS patients should be admitted preferably to dedicated **chest pain units or coronary care units.**	I	C
It is recommended to use established risk scores **for prognosis and bleeding (e.g. GRACE, CRUSADE).**	I	B
A 12-lead ECG should be obtained within 10 min after first medical contact and immediately read by an experienced physician. This should be repeated in the case of recurrence of symptoms, and after 6–9 and 24 h, and before hospital discharge.	I	B
Additional ECG leads (V_3R, V_4R, V_7–V_9) are recommended when routine leads are inconclusive.	I	C

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Recommendations for diagnosis and risk stratification (2)

Recommendations	Class	Level
Blood has to be drawn promptly for troponin (cardiac troponin T or I) measurement. The result should be available within 60 min. The test should be repeated 6-9 h after initial assessment if the first measurement is not conclusive. Repeat testing after 12-24 h is advised if the clinical condition is still suggestive of ACS.	I	A
A rapid rule-out protocol (0 and 3 h) is recommended when highly sensitive troponin tests are available.	I	B
An echocardiogram is recommended for all patients to evaluate regional and global LV function and to rule in or rule out differential diagnoses.	I	C
Coronary angiography is indicated in patients in whom the extent of CAD or the culprit lesion has to be determined.	I	C
Coronary CT angiography should be considered as an alternative to invasive angiography to exclude ACS when there is a low to intermediate likelihood of CAD and when troponin and ECG are inconclusive.	IIa	B
In patients without recurrence of pain, normal ECG findings, negative troponins tests, and a low risk score, a non-invasive stress test for inducible ischaemia is recommended before deciding on an invasive strategy.	I	A

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Laatste dia

- Vragen en discussie