# Utilità degli score prognostici cardiovascolari per il medico di pronto soccorso

XI congresso nazionale
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# DEFINITION

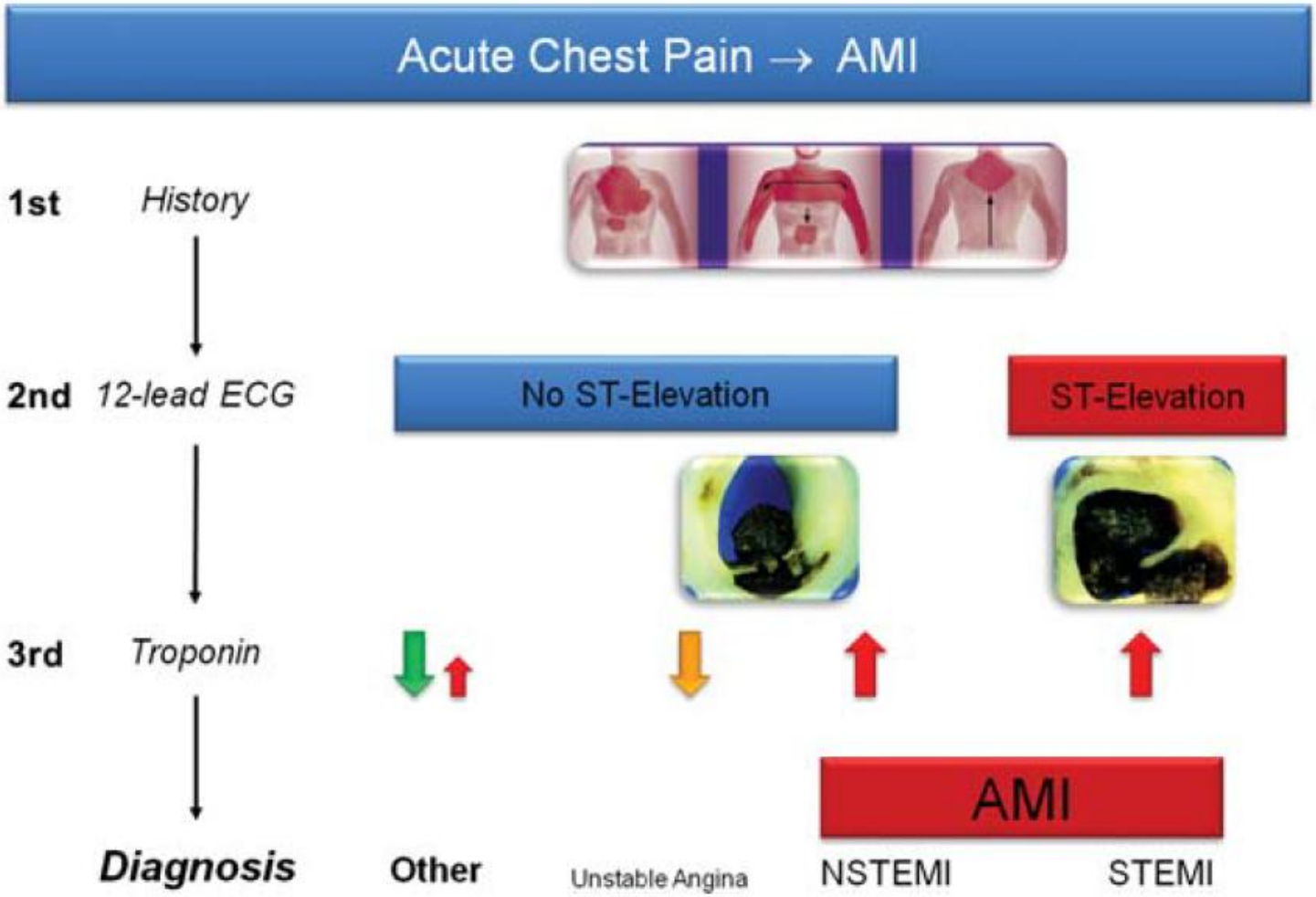
*Classification systems may help to quantify symptoms and stages of disease, specific scores enable risk stratification and may facilitate decision-making in various cardiac disorders*

*The number of points, goals, runs, etc. achieved in a game or by a team or an individual.*

# THE CHALLENGE: ACUTE CHEST PAIN

| Cardiac | Pulmonary | Vascular | Gastro-intestinal | Orthopaedic | Other |
|---|---|---|---|---|---|
| Myopericarditis Cardiomyopathies[3] | Pulmonary embolism | Aortic dissection | Oesophagitis, reflus or spasm | Musculoskeletal disorders | Anxiety disorders |
| Tachyarrhythmias | (Tension)-Pneumothorax | Symptomatic aortic aneurysm | Peptic ulcer, gastritis | Chest trauma | Herpes zoster |
| Acute heart failure | Bronchitis, pneumonia | Stroke | Pancreatitis | Muscle injury/ inflammation | Anaemia |
| Hypertensive emergencies | Pleuritis | | Cholecystitis | Costochondritis | |
| Aortic valve stenosis | | | | Cervical spine pathologies | |
| Tako-Tsubo cardiomyopathy | | | | | |
| Coronary spasm | | | | | |
| Cardiac trauma | | | | | |

Hospital attendances and admissions for acute chest pain present a substantial burden, accounting for 5% of all emergency department attendances, and 40% of acute medical admissions

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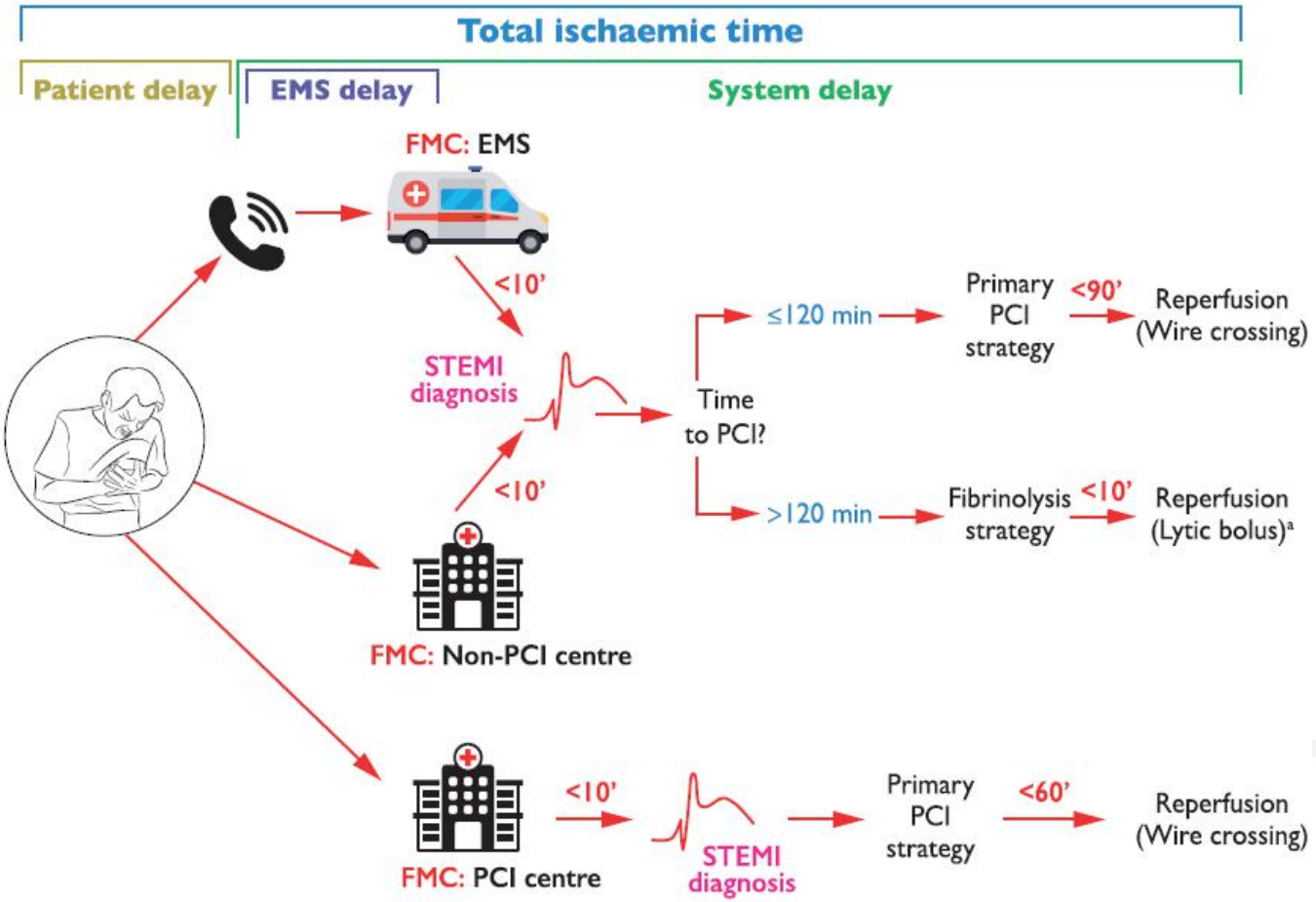
Twerenbold R et al. Eur Heart J 2012.

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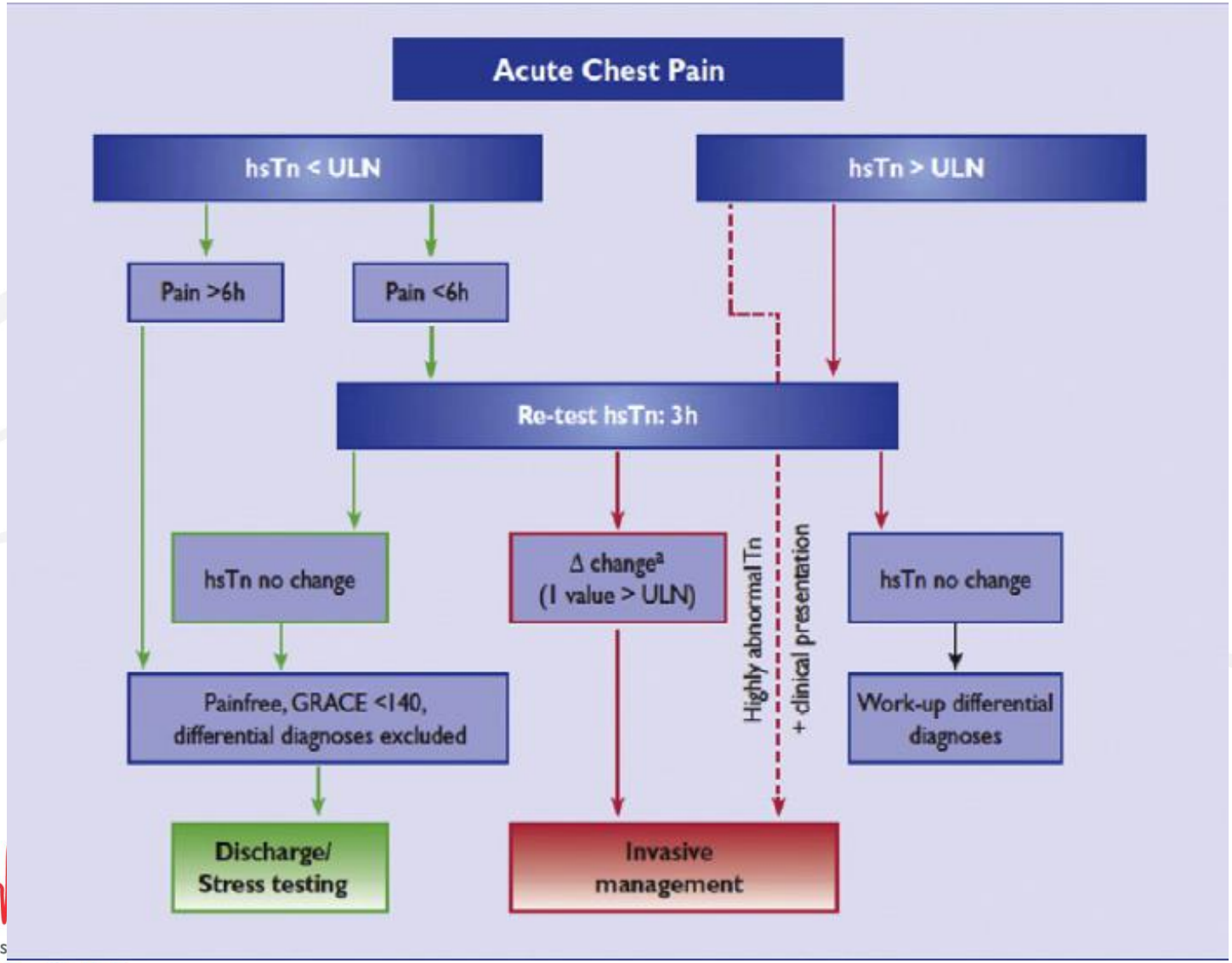
European Heart Journal (2018) 39, 119–177

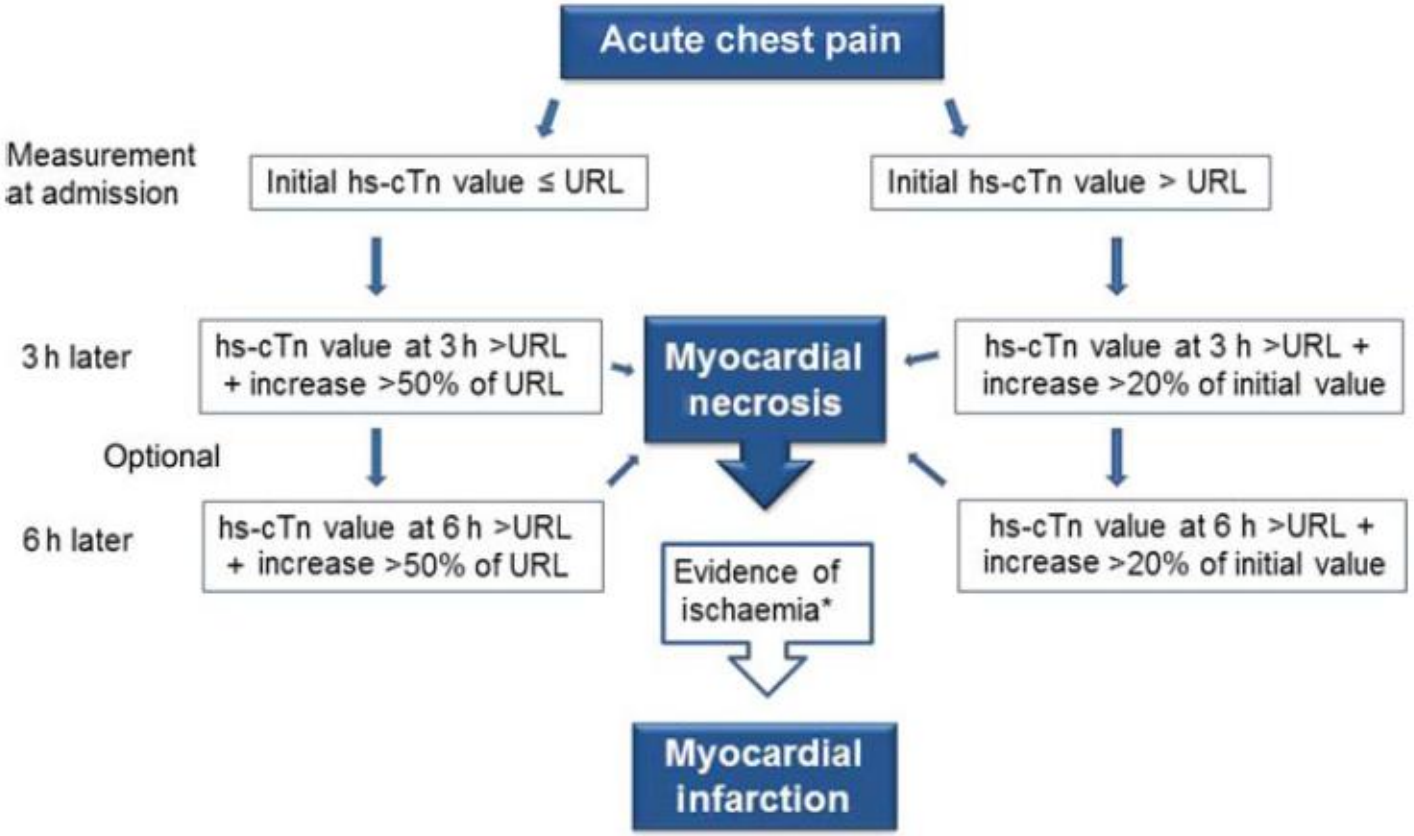
# The ECG
## The Diagnostic Key?

- The standard ECG is the single best test to identify patients with an AMI upon E.D. presentation
- But sensitivity is still far from ideal
  - ST elevation in 50% of **AMI's**
  - 1-5% of **AMI's** have a normal initial ECG
  - 4 - 23% of pts. with unstable angina have a normal ECG



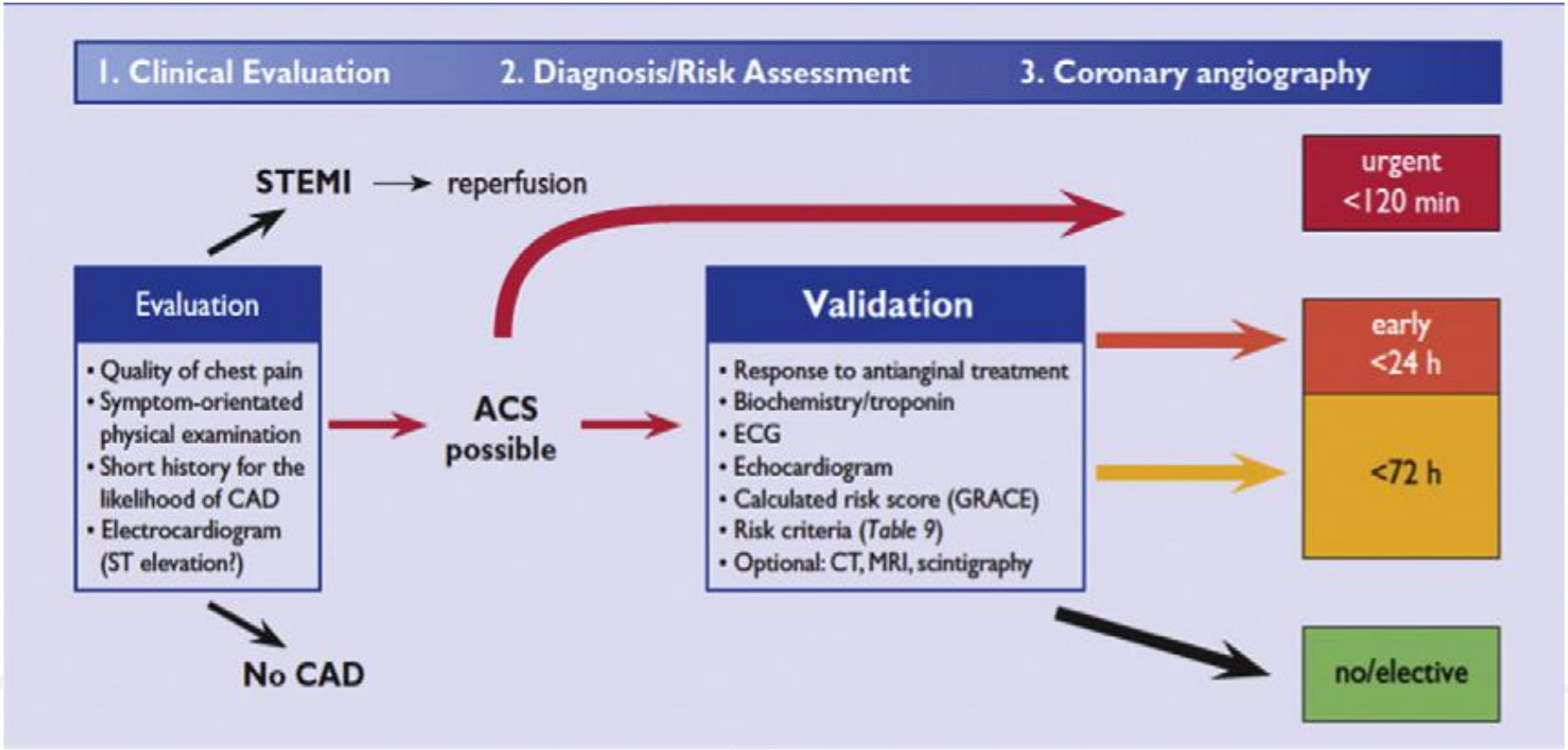

ESC rapid rule-out of ACS with hs-cTn algorithm.

## Rapid early rule-in of AMI with high-sensitivity cardiac troponin




The current ESC guideline on the use of hs-cTn recommends that for patients with a negative initial hs-cTn or values close to the upper reference limit URL, a 50% delta value or an absolute increase of 7 ng/L at 3 h can be used to diagnose MI. In patients with elevated hs-cTn at presentation, a delta value of 20% at 3 h can be used.

Thygesen K et al. Eur H Journal 2012.

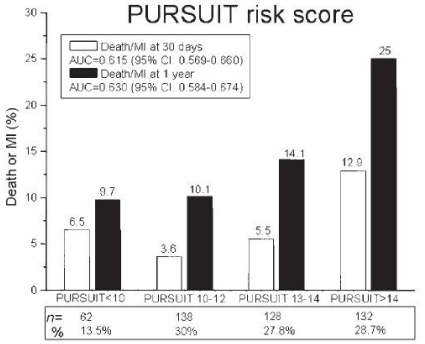

1. Clinical Evaluation
2. Diagnosis/Risk Assessment
3. Coronary angiography
STEMI
reperfusion
urgent
<120 min
Evaluation
• Quality of chest pain
• Symptom-orientated physical examination
• Short history for the likelihood of CAD
• Electrocardiogram (ST elevation?)
ACS possible
Validation
• Response to antianginal treatment
• Biochemistry/troponin
• ECG
• Echocardiogram
• Calculated risk score (GRACE)
• Risk criteria (Table 9)
• Optional: CT, MRI, scintigraphy
early
<24 h
<72 h
No CAD
no/elective

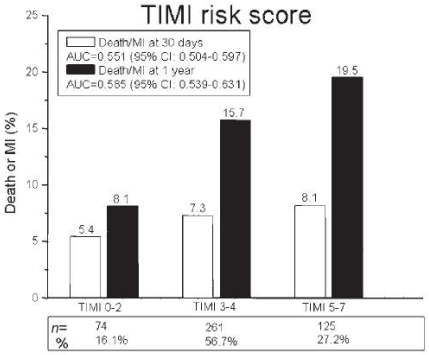
# TIMI, PURSUIT, and GRACE risk scores: sustained prognostic value and interaction with revascularization in NSTE-ACS

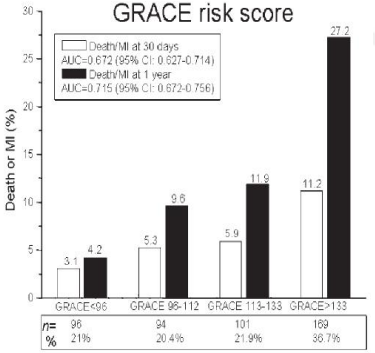
| | | |
|---|---|---|
| PURSUIT (0–18) | Age, separate points for enrolment diagnosis Decade [UA (MI)] | |
| | 50 | 8 (11) |
| | 60 | 9 (12) |
| | 70 | 11 (13) |
| | 80 | 12 (14) |
| | Sex | |
| | Male | 1 |
| | Female | 0 |
| | Worst CCS-class in previous 6 weeks | |
| | No angina or CCS I/II | 0 |
| | CCS III/IV | 2 |
| | Signs of heart failure | 2 |
| | ST-depression on presenting ECG | 1 |

| | | |
|---|---|---|
| TIMI (0–7) | Age ≥65 years | 1 |
| | ≥3 risk factors for CAD | 1 |
| | Use of ASA (last 7 days) | 1 |
| | Known CAD (stenosis ≥50%) | 1 |
| | >1 episode rest angina in <24 h | 1 |
| | ST-segment deviation | 1 |
| | Elevated cardiac markers | 1 |

| | | |
|---|---|---|
| GRACE (0–258) | Age (years) | |
| | <40 | 0 |
| | 40–49 | 18 |
| | 50–59 | 36 |
| | 60–69 | 55 |
| | 70–79 | 73 |
| | ≥80 | 91 |
| | Heart rate (bpm) | |
| | <70 | 0 |
| | 70–89 | 7 |
| | 90–109 | 13 |
| | 110–149 | 23 |
| | 150–199 | 36 |
| | >200 | 46 |
| | Systolic BP (mmHg) | |
| | <80 | 63 |
| | 80–99 | 58 |
| | 100–119 | 47 |
| | 120–139 | 37 |
| | 140–159 | 26 |
| | 160–199 | 11 |
| | >200 | 0 |
| | Creatinine (mg/dL) | |
| | 0–0.39 | 2 |
| | 0.4–0.79 | 5 |
| | 0.8–1.19 | 8 |
| | 1.2–1.59 | 11 |
| | 1.6–1.99 | 14 |
| | 2–3.99 | 23 |
| | >4 | 31 |
| | Killip class | |
| | Class I | 0 |
| | Class II | 21 |
| | Class III | 43 |
| | Class IV | 64 |
| | Cardiac arrest at admission | 43 |
| | Elevated cardiac markers | 15 |
| | ST-segment deviation | 30 |

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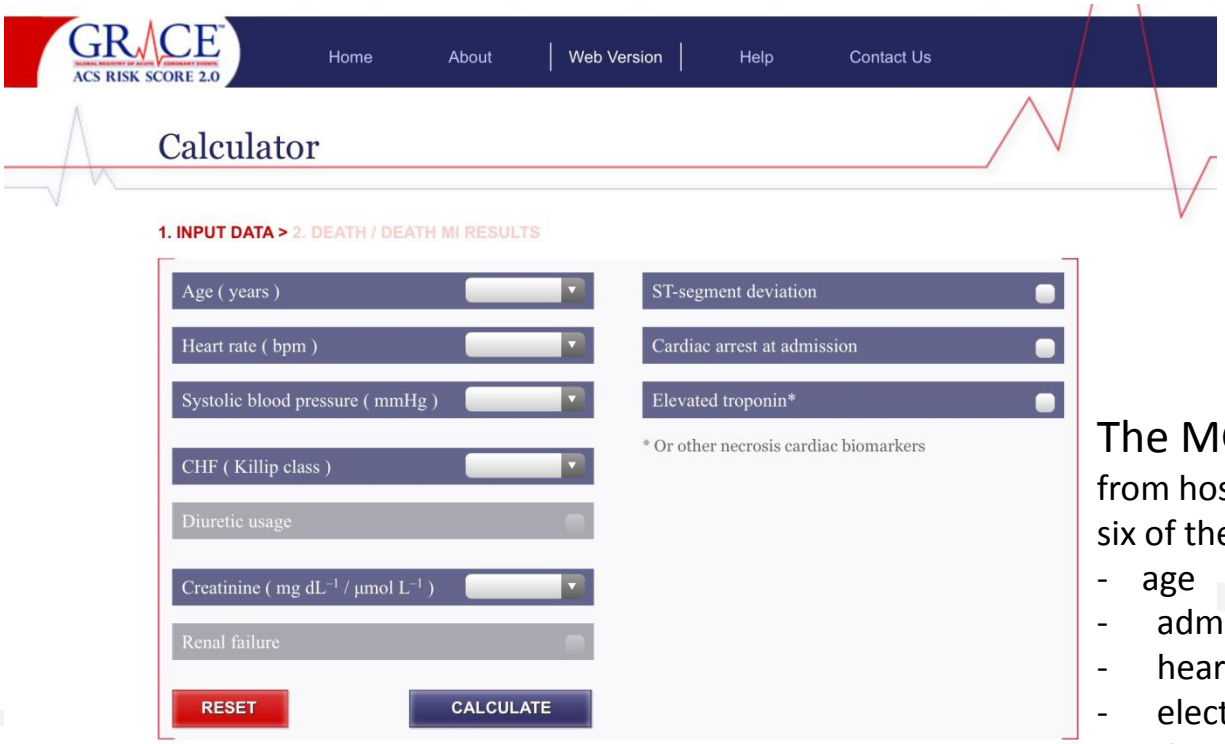
de Araújo Gonçalves P et al. Eur Heart J 2005.

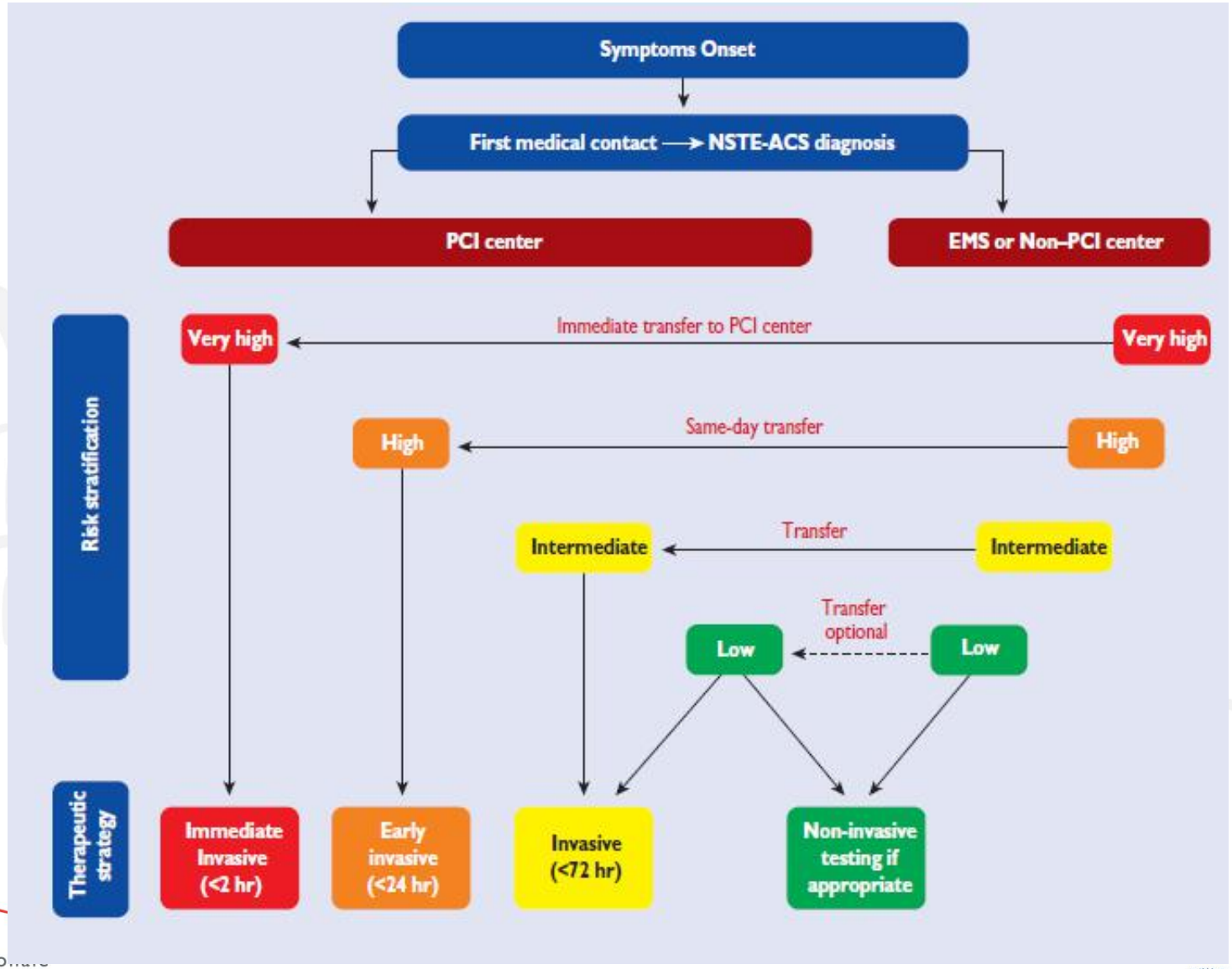
# MINI-GRACE SCORE



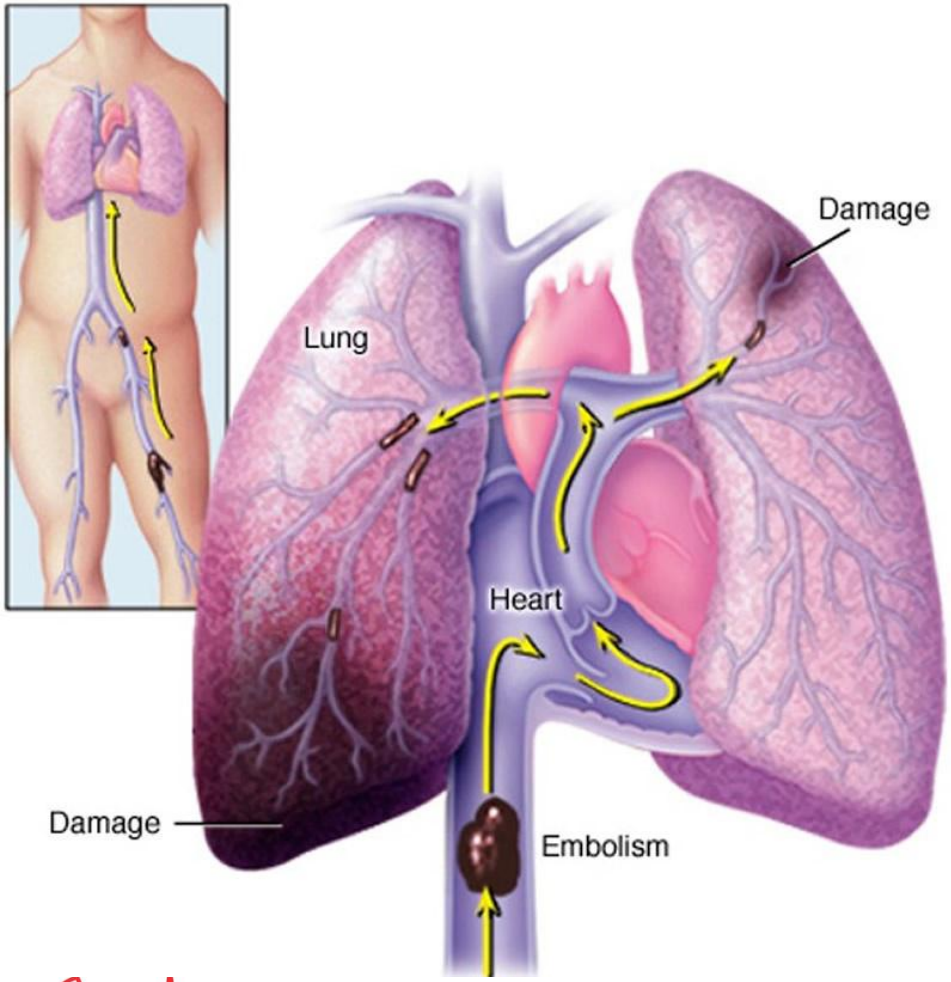

The MG risk score for 6 month mortality from hospitalization with AMI comprised six of the eight GRACE variables:

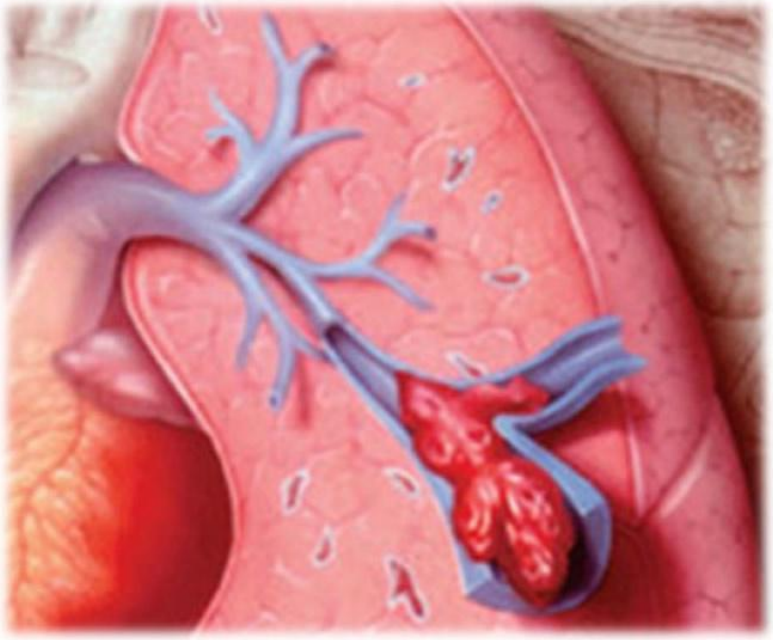
- age
- admission systolic blood pressure
- heart rate
- electrocardiographic ST segment deviation
- cardiac arrest
- elevated cardiac enzymes (defined as a cardiac troponin concentration >0.05 ng/ml).

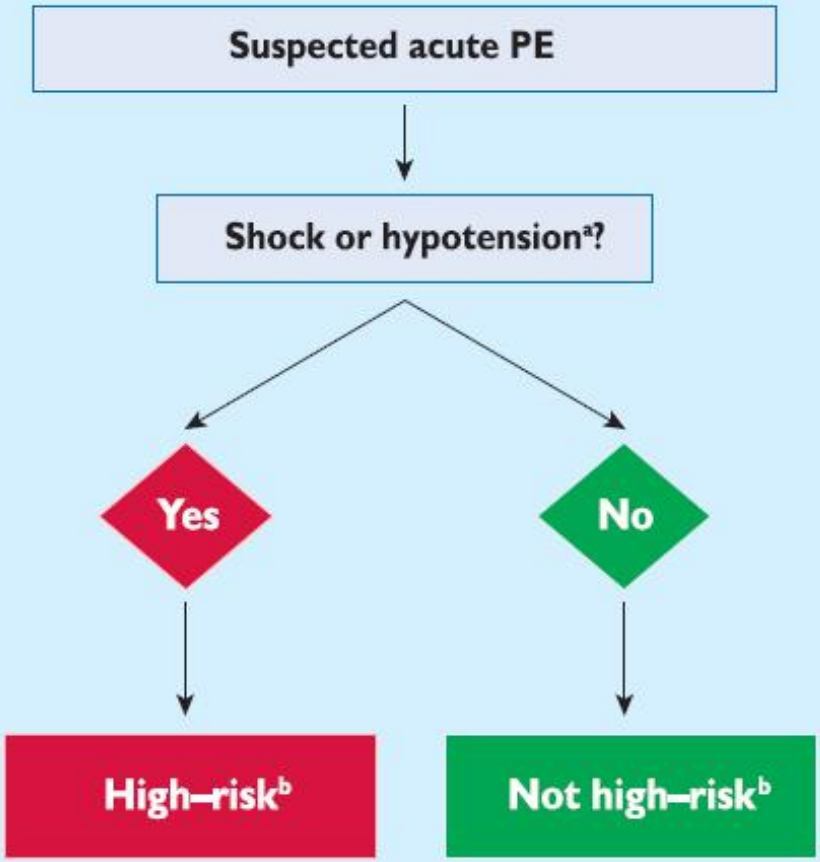
Simms AD et al. Heart 2013


Symptoms Onset
First medical contact → NSTE-ACS diagnosis
PCI center
EMS or Non–PCI center
Risk stratification
Very high
Immediate transfer to PCI center
Very high
High
Same-day transfer
High
Intermediate
Transfer
Intermediate
Transfer optional
Low
Low
Therapeutic strategy
Immediate Invasive (<2 hr)
Early invasive (<24 hr)
Invasive (<72 hr)
Non-invasive testing if appropriate

# Pulmonary Embolism





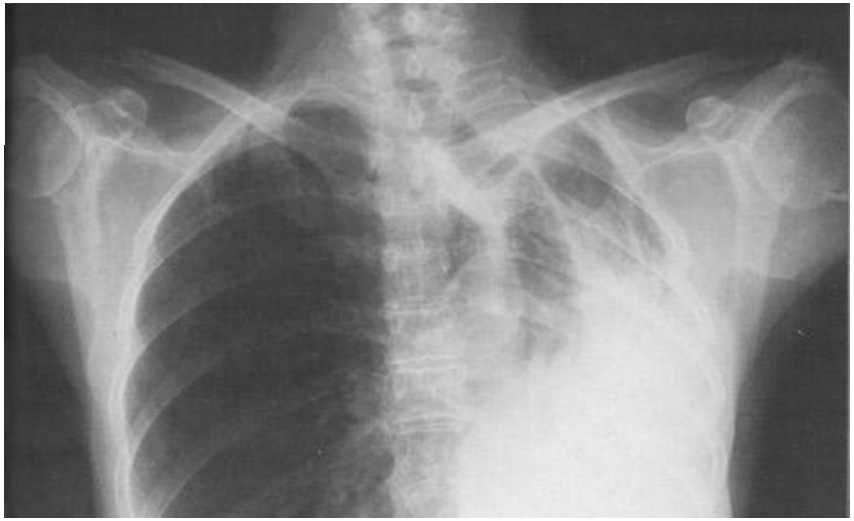

PE = pulmonary embolism.
[a]Defined as systolic blood pressure <90 mm Hg, or a systolic pressure drop by ≥40 mm Hg, for >15 minutes, if not caused by new-onset arrhythmia, hypovolaemia, or sepsis.
[b]Based on the estimated PE-related in-hospital or 30-day mortality.

| Early mortality risk | | Risk parameters and scores | | | |
|---|---|---|---|---|---|
| | | Shock or hypotension | PESI class III-V or sPESI ≥1[a] | Signs of RV dysfunction on an imaging test[b] | Cardiac laboratory biomarkers[c] |
| High | | + | (+)[d] | + | (+)[d] |
| Intermediate | Intermediate–high | – | + | Both positive | |
| | Intermediate–low | – | + | Either one (or none) positive[e] | |
| Low | | – | – | Assessment optional; if assessed, both negative[e] | |

| Recommendations | Class[a] | Level[b] |
|---|---|---|
| Initial risk stratification of suspected or confirmed PE—based on the presence of shock or persistent hypotension—is recommended to identify patients at high risk of early mortality. | I | B |
| In patients not at high risk, use of a validated clinical risk prediction score, preferably the PESI or sPESI, should be considered to distinguish between low- and intermediate-risk PE. | IIa | B |
| In patients at intermediate risk, assessment of the right ventricle with echocardiography or CT, and of myocardial injury using a laboratory biomarker, should be considered for further risk stratification. | IIa | B |

# Clinical presentation

| Feature | PE confirmed (*n* = 1880) | PE not confirmed (*n* = 528) |
|---|---|---|
| Dyspnoea | 50% | 51% |
| Pleuritic chest pain | 39% | 28% |
| Cough | 23% | 23% |
| Substernal chest pain | 15% | 17% |
| Fever | 10% | 10% |
| Haemoptysis | 8% | 4% |
| Syncope | 6% | 6% |
| Unilateral leg pain | 6% | 5% |
| Signs of DVT (unilateral extremity swelling) | 24% | 18% |



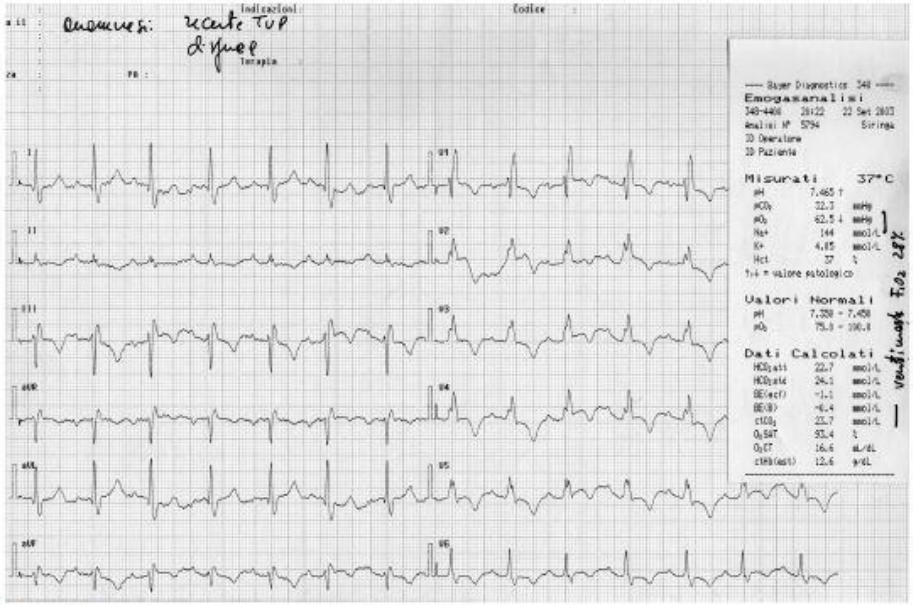


Figura 1

# ESC Guidelines

| Items | Clinical decision rule points | |
|---|---|---|
| **Wells rule** | **Original version[95]** | **Simplified version[107]** |
| Previous PE or DVT | 1.5 | 1 |
| Heart rate ≥100 b.p.m. | 1.5 | 1 |
| Surgery or immobilization within the past four weeks | 1.5 | 1 |
| Haemoptysis | 1 | 1 |
| Active cancer | 1 | 1 |
| Clinical signs of DVT | 3 | 1 |
| Alternative diagnosis less likely than PE | 3 | 1 |
| **Clinical probability** | | |
| *Three-level score* | | |
| Low | 0–1 | N/A |
| Intermediate | 2–6 | N/A |
| High | ≥7 | N/A |
| *Two-level score* | | |
| PE unlikely | 0–4 | 0–1 |
| PE likely | ≥5 | ≥2 |

| Revised Geneva score | Original version[93] | Simplified version[108] |
|---|---|---|
| Previous PE or DVT | 3 | 1 |
| Heart rate<br>75–94 b.p.m.<br>≥95 b.p.m. | <br>3<br>5 | <br>1<br>2 |
| Surgery or fracture within the past month | 2 | 1 |
| Haemoptysis | 2 | 1 |
| Active cancer | 2 | 1 |
| Unilateral lower limb pain | 3 | 1 |
| Pain on lower limb deep venous palpation and unilateral oedema | 4 | 1 |
| Age >65 years | 1 | 1 |
| **Clinical probability** | | |
| *Three-level score* | | |
| Low | 0–3 | 0–1 |
| Intermediate | 4–10 | 2–4 |
| High | ≥11 | ≥5 |
| *Two-level score* | | |
| PE unlikely | 0–5 | 0–2 |
| PE likely | ≥6 | ≥3 |

# USE OF THE D-DIMER FOR DETECTING PULMONARY EMBOLISM IN THE EMERGENCY DEPARTMENT

**Table 4. Imaging Results of Patients With False-Negative D-dimer**

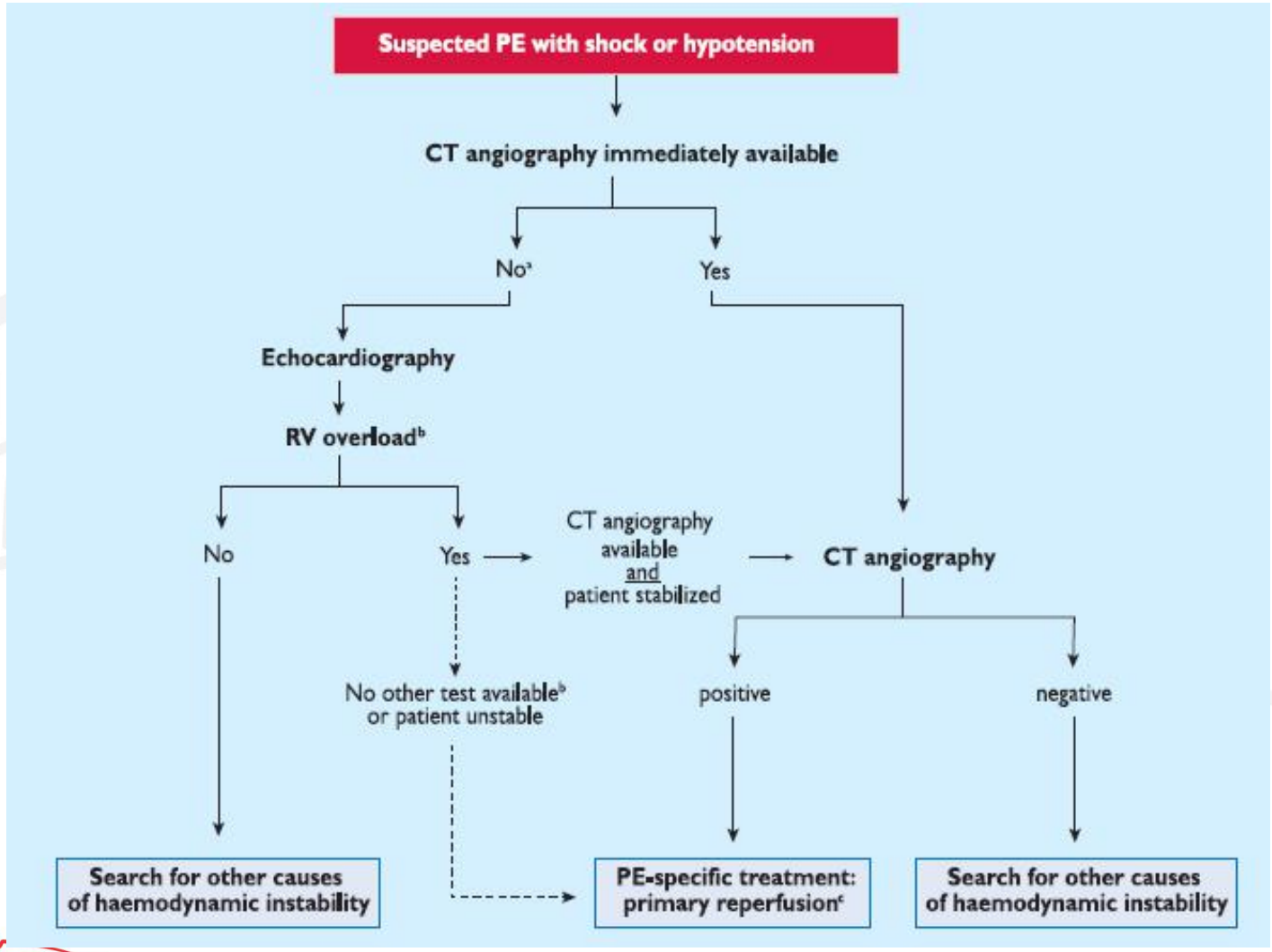
| Imaging Results |
|---|
| Small segmental PEs |
| Acute subsegmental PE |
| Solitary small PE |
| Segmental to subsegmental PE |
| Small segmental PE |
| A new nonocclusive thrombus in the right distal main pulmonary artery extending into several segmental branches |
| Segmental to subsegmental pulmonary thromboembolic disease in the right upper and right middle lobes |
| Possible bilateral nonocclusive segmental/subsegmental pulmonary thromboembolism |
| High probability VQ scan |

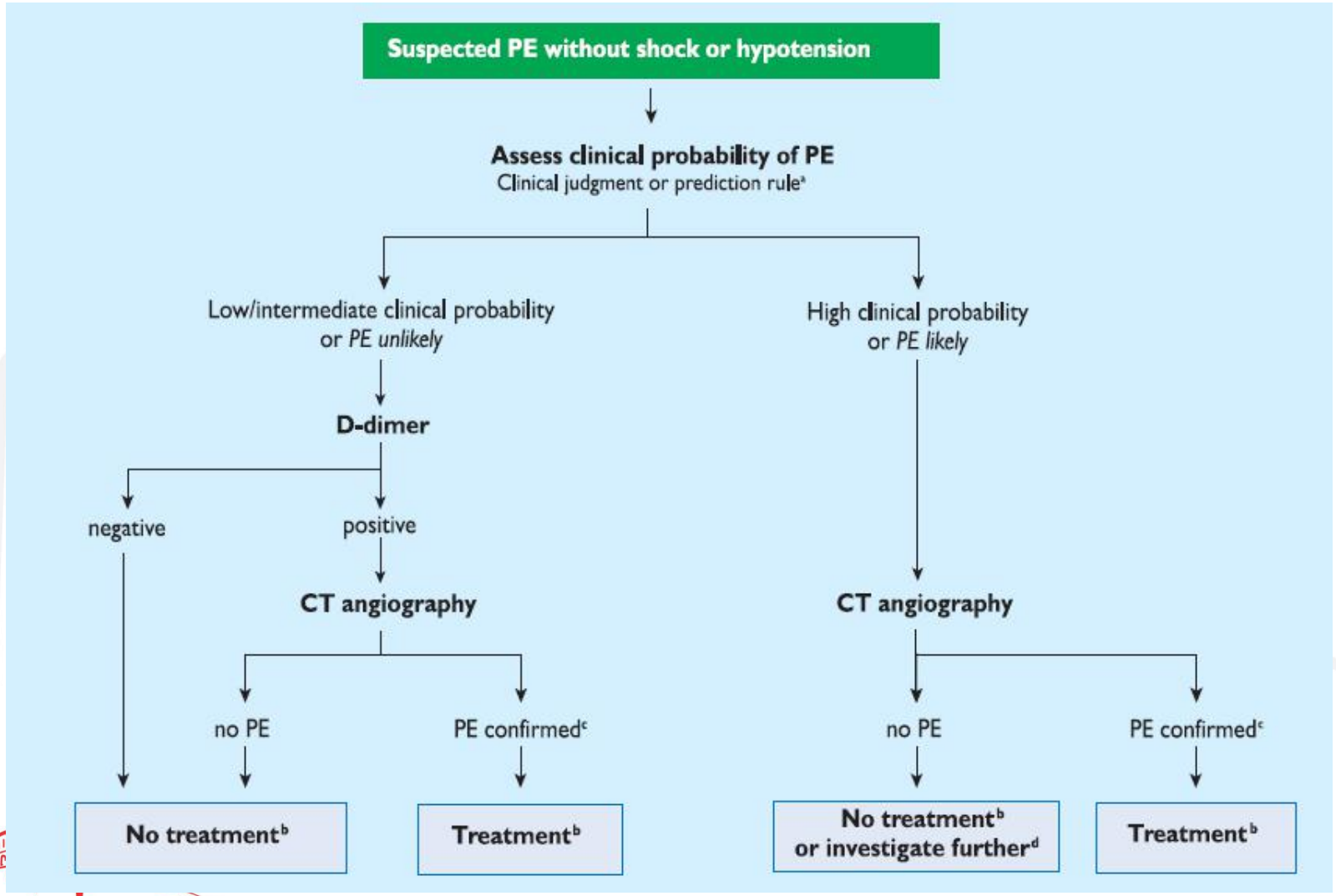
**Table 3. Bivariate Characteristics of Patients With False-Negative D-dimer**

| Characteristic | n (%) |
|---|---|
| Male | 7 (78) |
| Cancer | 0 (0) |
| History of PE/DVT | 4 (44) |
| Pregnant | 0 (0) |
| COPD | 1 (11) |
| Recent surgery | 1 (11) |
| Exogenous estrogen | 0 (0) |
| Shortness of breath | 5 (56) |
| Cough | 4 (44) |
| Hemoptysis | 1 (11) |
| Syncope | 1 (11) |
| Fever > 100.4°F | 0 (0) |
| Unilateral leg swelling | 0 (0) |
| Current smoker | 2 (22) |
| Positive DVT US | 0 (0) |



Glober N et al. J Emerg Med. 2018

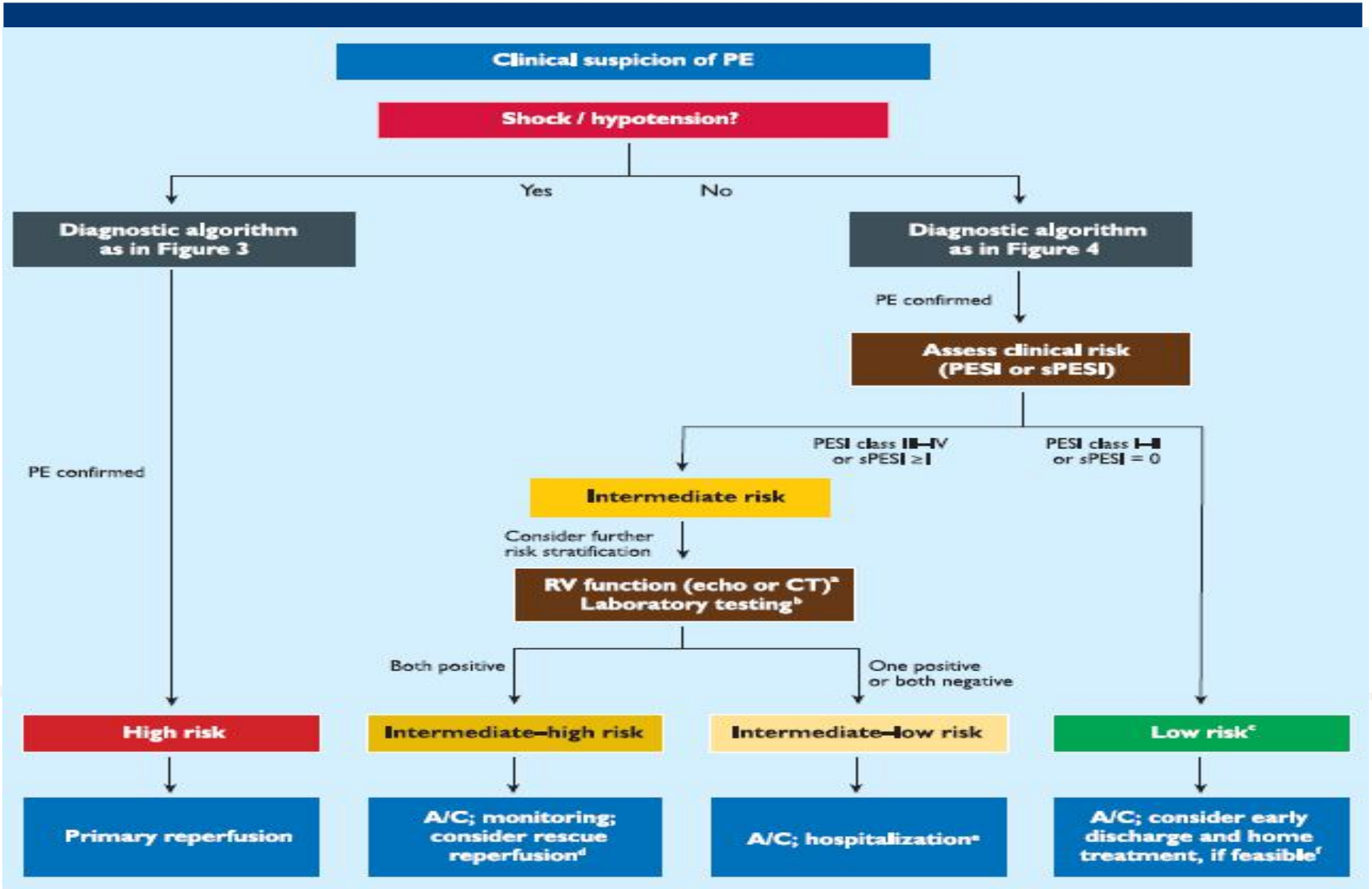

Suspected PE with shock or hypotension
CT angiography immediately available
No[a]
Yes
Echocardiography
RV overload[b]
No
Yes
CT angiography available and patient stabilized
CT angiography
No other test available[b] or patient unstable
positive
negative
Search for other causes of haemodynamic instability
PE-specific treatment: primary reperfusion[c]
Search for other causes of haemodynamic instability


Suspected PE without shock or hypotension
Assess clinical probability of PE
Clinical judgment or prediction rule[a]
Low/intermediate clinical probability or PE unlikely
High clinical probability or PE likely
D-dimer
negative
positive
CT angiography
CT angiography
no PE
PE confirmed[c]
no PE
PE confirmed[c]
No treatment[b]
Treatment[b]
No treatment[b] or investigate further[d]
Treatment[b]

# Pulmonary embolism severity index (PESI)

| Parameter | Original version[214] | Simplified version[218] |
|---|---|---|
| Age | Age in years | 1 point (if age >80 years) |
| Male sex | +10 points | – |
| Cancer | +30 points | 1 point |
| Chronic heart failure | +10 points | 1 point |
| Chronic pulmonary disease | +10 points | |
| Pulse rate ≥110 b.p.m. | +20 points | 1 point |
| Systolic blood pressure <100 mm Hg | +30 points | 1 point |
| Respiratory rate >30 breaths per minute | +20 points | – |
| Temperature <36 °C | +20 points | – |
| Altered mental status | +60 points | – |
| Arterial oxyhaemoglobin saturation <90% | +20 points | 1 point |
| | Risk strata[a] | |
| | **Class I:≤65 points**<br>very low 30-day mortality risk (0–1.6%)<br>**Class II: 66–85 points**<br>low mortality risk (1.7–3.5%)<br><br>**Class III: 86–105 points**<br>moderate mortality risk (3.2–7.1%)<br>**Class IV: 106–125 points**<br>high mortality risk (4.0–11.4%)<br>**Class V: >125 points**<br>very high mortality risk (10.0–24.5%) | **0 points**= 30-day mortality risk 1.0%<br>(95% CI 0.0%–2.1%)<br><br>**≥1 point(s)**= 30-day mortality risk 10.9%<br>(95% CI 8.5%–13.2%) |

Il PESI è lo score più ampiamente convalidato fino ad oggi nella valutazione prognostica dei pz con EP acuta


Clinical suspicion of PE
Shock / hypotension?
Yes
No
Diagnostic algorithm as in Figure 3
Diagnostic algorithm as in Figure 4
PE confirmed
Assess clinical risk (PESI or sPESI)
PESI class III–IV or sPESI ≥1
PESI class I–II or sPESI = 0
PE confirmed
Intermediate risk
Consider further risk stratification
RV function (echo or CT)[a] Laboratory testing[b]
Both positive
One positive or both negative
High risk
Intermediate–high risk
Intermediate–low risk
Low risk[c]
Primary reperfusion
A/C; monitoring; consider rescue reperfusion[d]
A/C; hospitalization[e]
A/C; consider early discharge and home treatment, if feasible[f]

# Pulmonary embolism rule-out criteria (PERC) rule in European patients with low implicit clinical probability (PERCEPIC): a multicentre, prospective, observational study

## Pulmonary Embolism Rule-Out Criteria

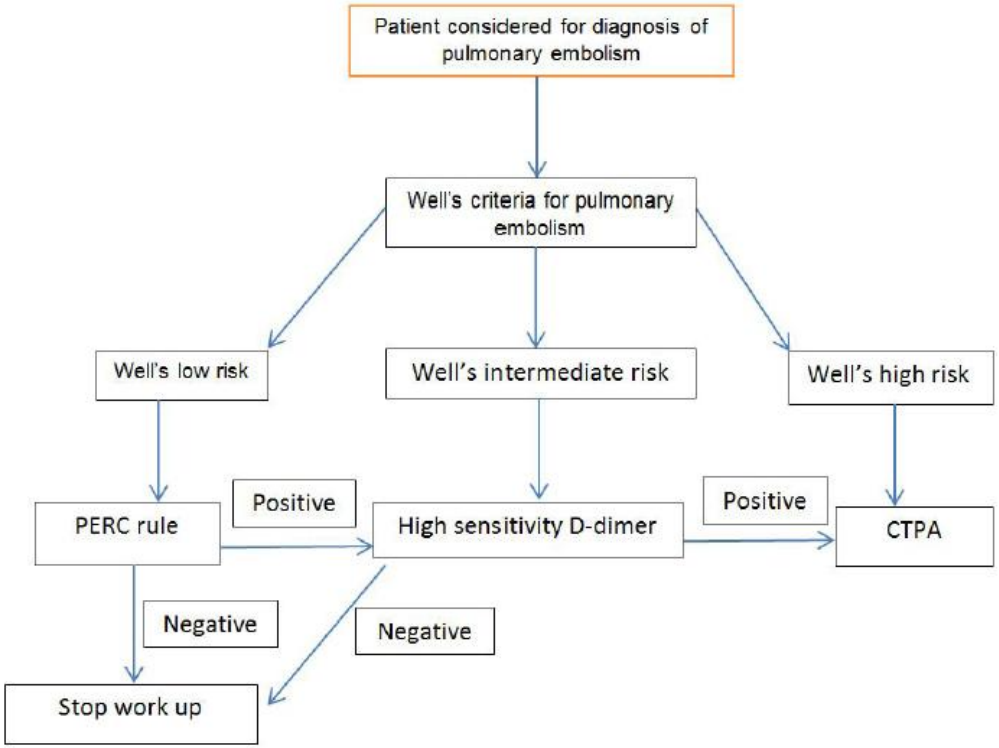
| Variable |
| --- |
| Age <50 years |
| Pulse <100 beats per minute |
| $SaO_2$ ≥95% on room air |
| No hemoptysis |
| No exogenous estrogen use |
| No prior venous thromboembolism |
| No surgery or trauma requiring hospitalization within the past 4 weeks |
| No unilateral leg swelling |

Journal WATCH

To limit the use of unnecessary, costly, time-consuming, and potentially harmful investigations in patients suspected of pulmonary embolism, Kline and colleagues developed the pulmonary embolism rule-out criteria (PERC), a clinical decision rule, based on eight parameters easily available at initial emergency department assessment.

***Lancet Haematol* 2017;**

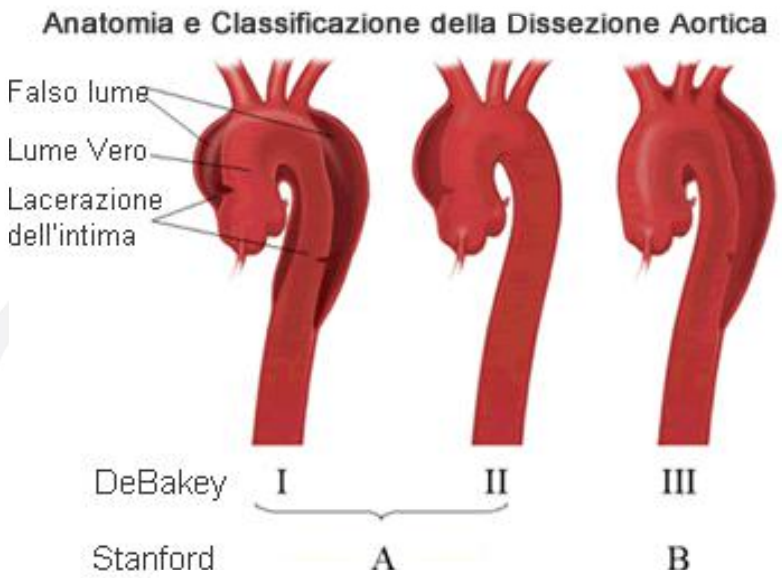
# Knowledge Translation of the PERC Rule for Suspected Pulmonary Embolism: A Blueprint for Reducing the Number of CT Pulmonary Angiograms

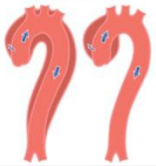



Results: CTPA declined from 1,033 scans for 98,028 annual visits (10.53 per 1,000 patient visits (95% CI [9.9-11.2]) to 892 scans for 101,172 annual visits (8.81 per 1,000 patient visits (95% CI [8.3-9.4]) p<0.001. The absolute reduction in PACT ordered was 1.72 per 1,000 visits (a 16% reduction). Patient characteristics were similar for both periods.

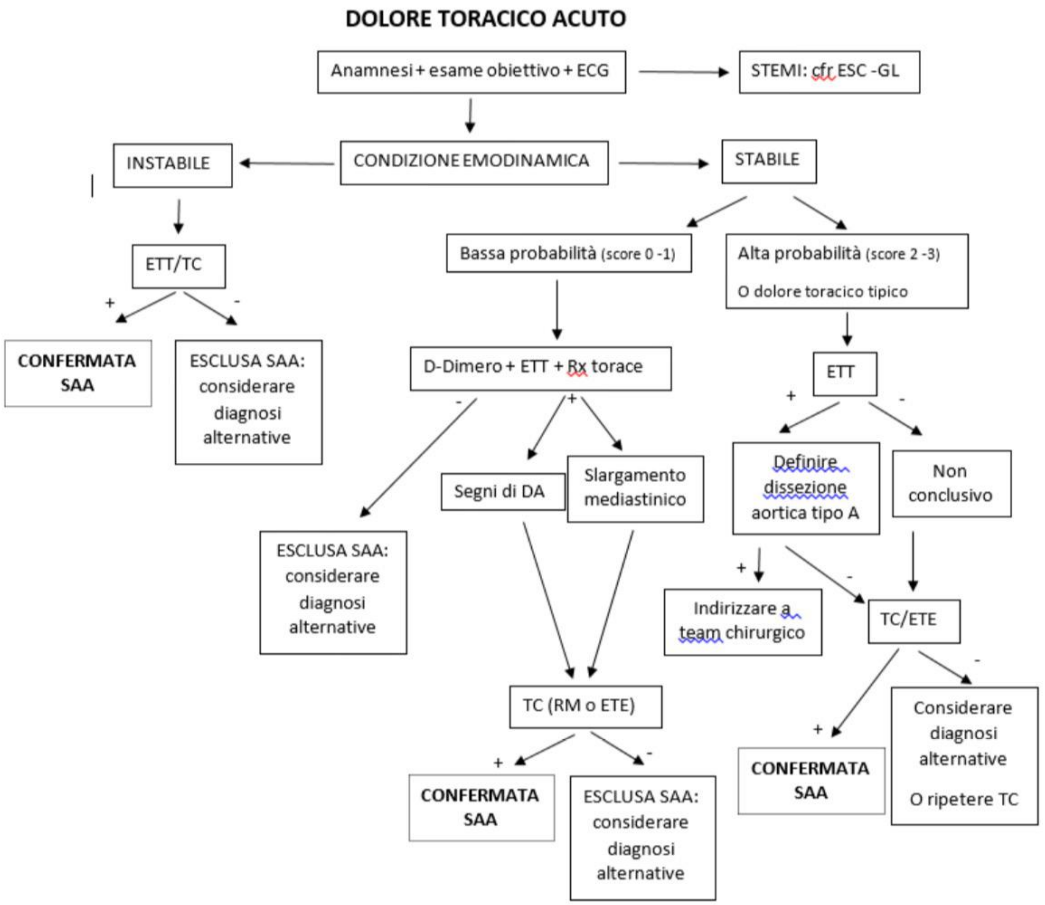
West J Emerg Med. 2017

# AORTIC DISSECTION




| | STANFORD A  | STANFORD B  |
|---|---|---|
| Dolore toracico | 80% | 70% |
| Dolore dorsale | 40% | 70% |
| Dolore migrante | 85% | 85% |
| Insufficienza aortica moderato-severa | 40 – 75% | ---------- |
| Tamponamento cardiaco | 10 – 20% | ---------- |
| Sindrome coronarica acuta | 10 – 15% | 10% |
| Scompenso cardiaco | 10% | 5% |
| Versamento pleurico | 15% | 20% |
| Sincope | 15% | 5% |
| Deficit neurologici | 10% | 5% |
| Insufficienza renale acuta | 20% | 10% |
| Ischemia arti inferiori | 10% | 10% |

| Dati clinici utili a stabilire la probabilità " a priori" di SAA | | |
|---|---|---|
| Condizioni ad alto rischio | Tipo di dolore ad alto rischio | Caratteristiche cliniche ad alto rischio |
| ✓ S. Marfan (o altra connettivopatia)<br>✓ Anamnesi familiare positiva per malattia aortica<br>✓ Malattia aortica nota<br>✓ Aneurisma aorta toracica noto<br>✓ Pregressa procedura invasiva coinvolgente l'aorta (inclusa chirurgia cardiaca) | Dolore taracico/addominale/dorsale con una delle seguenti caratteristiche:<br>- Inizio improvviso<br>- Intensità severa<br>- Di tipo "squarciante" | Evidenza di deficit perfusivo per:<br>- Ipofigmia<br>- Differenza di PA sistolica in diversi punti di misurazione<br>- Deficit focale neurologico<br>- Soffio diastolico aortico di nuova insorgenza<br>- Ipotensione/shock |




| Raccomandazione | Classe | Livello |
|---|---|---|
| Valutazione anamnestica e clinica | | |
| Accurata raccolta dell'anamnesi e delle caratteristiche clinico-semeiologiche | I | B |
| Test di laboratorio | | |
| L'interpretazione dei biomarkers non deve essere disgiunta dalla valutazione di probabilità clinica pre-test | IIa | C |
| In caso di bassa probabilità clinica, la negatività del DDimero deve essere considerata diagnostica nella esclusione della SAA | IIa | B |
| In caso di probabilità clinica intermedia e positività del DDimero deve approfondito l'iter diagnostico con test di imaging | IIa | B |
| In caso di elevata probabilità di DA la valutazione del DDimero non è indicata | III | C |
| Imaging | | |
| ETT è raccomandato come valutazione iniziale | I | C |
| In caso di pz instabile con sospetta SAA, è raccomandato eseguire (in relazione a disponibilità della metodica ed esperienza dell'operatore): | | |
| ETE | I | C |
| TC | I | C |
| In caso di pz stabile con sospetta SAA le seguenti metodiche sono raccomandate (o dovrebbero essere considerate) in relazione alla disponibilità della metodica ed all'esperienza dell'operatore | | |
| TC | I | C |
| RM | I | C |
| ETE | IIa | C |
| In caso di iniziale negatività dei test di imaging e persistenza di sospetto clinico di SAA, è raccomandato ripetere CT o RM | I | C |
| RX torace può essere considerato in caso di bassa probabilità di SAA | IIb | C |
| In caso di DA di tipo B non complicata, in terapia medica, è raccomandato ripetere TC o RM nei primi giorni | I | C |

Aortic pain with immediate onset, a tearing or ripping character, or both; mediastinal widening, aortic widening, or both on chest radiography; and pulse differentials, blood pressure differentials, or both (P<.001 for all) were identified as independent predictors of acute aortic dissection. Probability of dissection was low with absence of all 3 variables (7%), intermediate with isolated findings of aortic pain or mediastinal widening (31% and 39%, respectively), and high with isolated pulse or blood pressure differentials or any combination of the 3 variables (≥83%).

**Table 3. Risk for Types A and B Acute Aortic Dissection According to 3 Clinical Predictors**

| Variable | No. (%) of Patients | | Probability of Dissection, % |
|---|---|---|---|
| | Dissection (n = 128) | No Dissection (n = 122) | |
| No sign present | 5 (4) | 65 (53) | 7 |
| Aortic pain alone | 13 (10) | 29 (24) | 31 |
| Mediastinal widening, aortic widening, or both alone | 11 (9) | 17 (14) | 39 |
| Aortic pain + mediastinal widening, aortic widening, or both | 50 (39) | 10 (8) | 83 |
| Pulse differentials, blood pressure differentials, or both alone | 2 (2) | 0 | 100 |
| Aortic pain + pulse differentials, blood pressure differentials, or both | 11 (9) | 1 (1) | 92 |
| Mediastinal widening + pulse differentials, blood pressure differentials, or both | 2 (2) | 0 | 100 |
| Aortic pain + mediastinal widening, aortic widening, or both + pulse differentials, blood pressure differentials, or both | 34 (27) | 0 | 100 |

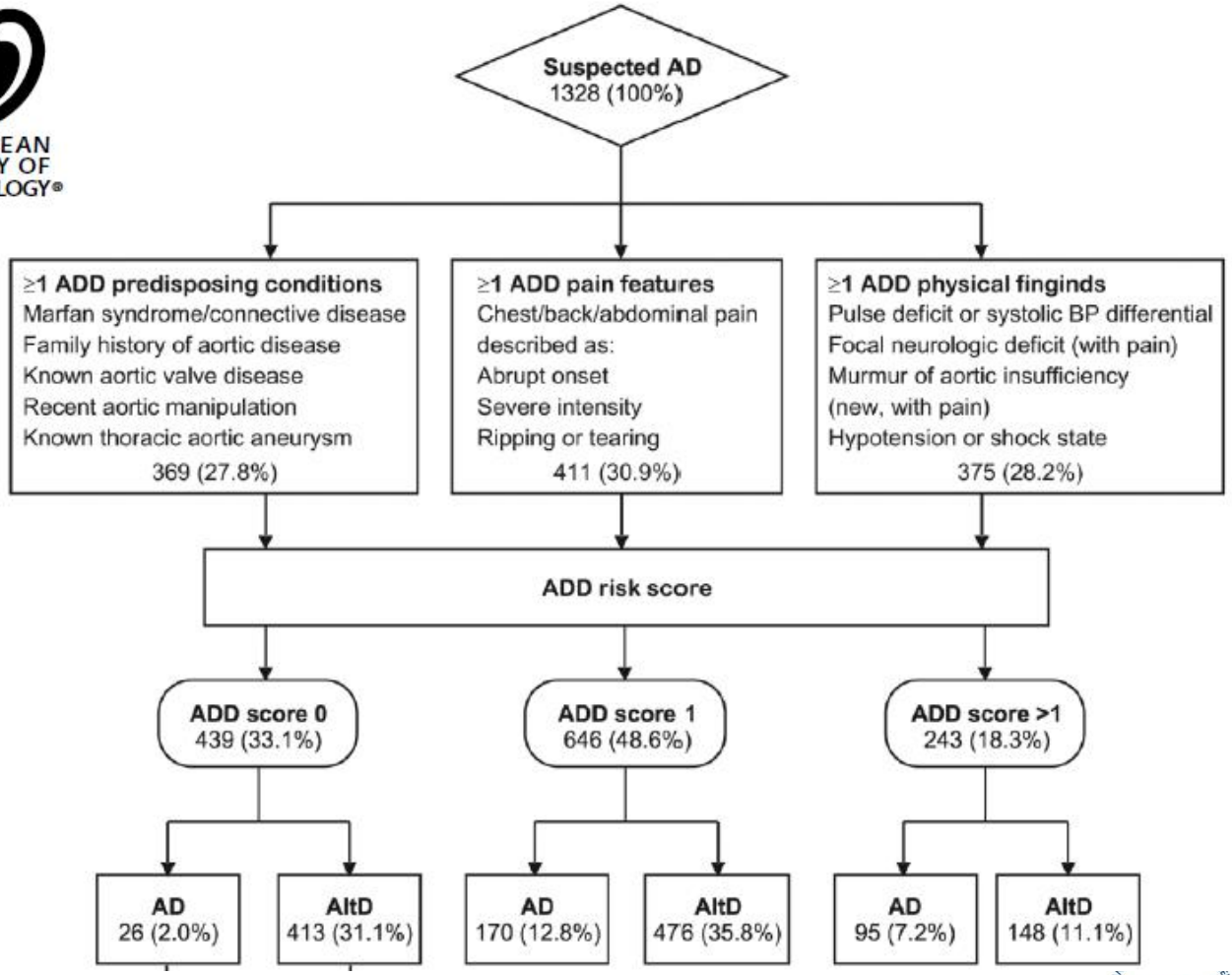


von Kodolitsch Y et al. Arch Intern Med. 2000

# Diagnostic performance of the aortic dissection detection risk score in patients with suspected acute aortic dissection

European Heart Journal Acute Cardiovascular Care

EUROPEAN SOCIETY OF CARDIOLOGY®

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Nazerian P et al. Eur Heart J Acute Cardiovasc Care. 2014

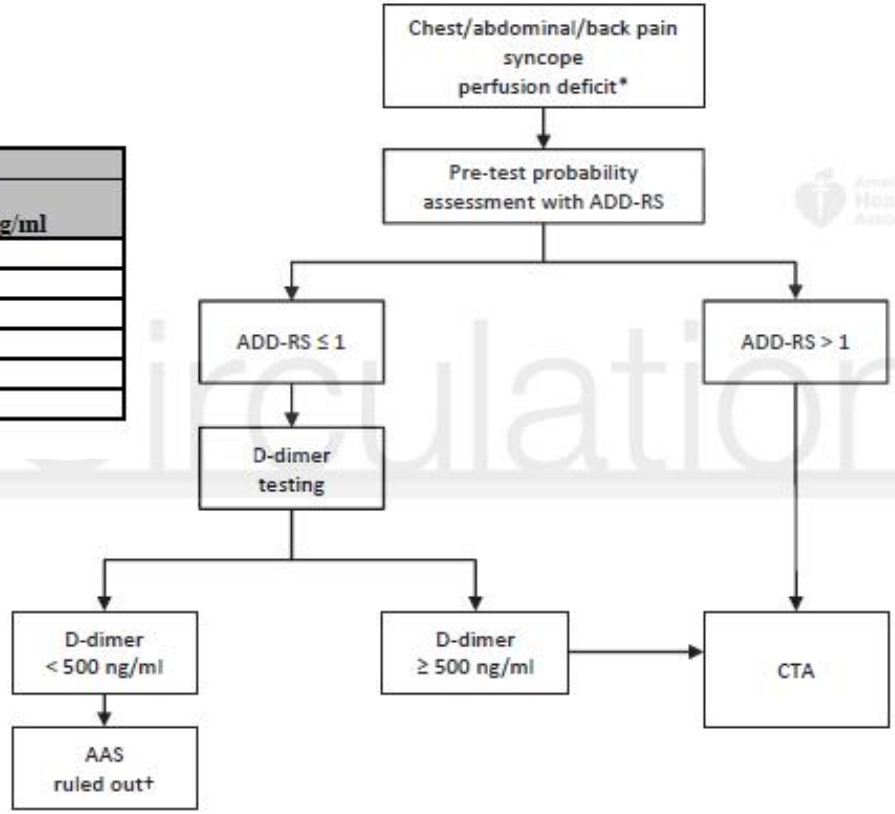
Circulation

American Heart Association

# Diagnostic Accuracy of the Aortic Dissection Detection Risk Score Plus D-Dimer for Acute Aortic Syndromes: The ADvISED Prospective Multicenter Study

| Diagnostic variables | Diagnostic strategy | |
|---|---|---|
| | ADD risk score = 0 plus D-dimer < 500 ng/ml | ADD risk score ≤ 1 plus D-dimer < 500 ng/ml |
| Sensitivity | 99.6% (97.7-100%) | 98.8% (96.4-99.7%) |
| Specificity | 18.2% (16.4-20.2%) | 57.3% (54.9-59.7%) |
| PPV | 15.4% (13.7-17.3%) | 25.8% (23-28.7%) |
| LR+ | 1.22 (1.19-1.25) | 2.31 (2.18-2.45) |
| NPV | 99.7% (98.1-100%) | 99.7% (99.1-99.9%) |
| LR- | 0.02 (0.003-0.16) | 0.02 (0.01-0.07) |

Variables are presented as percent and 95% confidence interval (in brackets).

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Nazerian P et al. Circulation. 2018

# CONCLUSIONI

*Emerging evidence worthy of mention illustrates that a physician Gestalt may perform better than sole reliance on clinical scoring systems. This new body of research illustrates the German concept of Gestalt theory, a philosophical and psychiatric principle in which the process is taken into consideration versus the content—in other words, the whole is not the sum of its parts, but greater than the sum of its parts. A physician's clinical judgment should not be replaced by clinical scoring systems, but should instead be used in conjunction with evidence-based validated systems when deciding the most likely diagnosis for a patient.*

- Dottore, comincio a dubitare delle sue diagnosi...

# Grazie