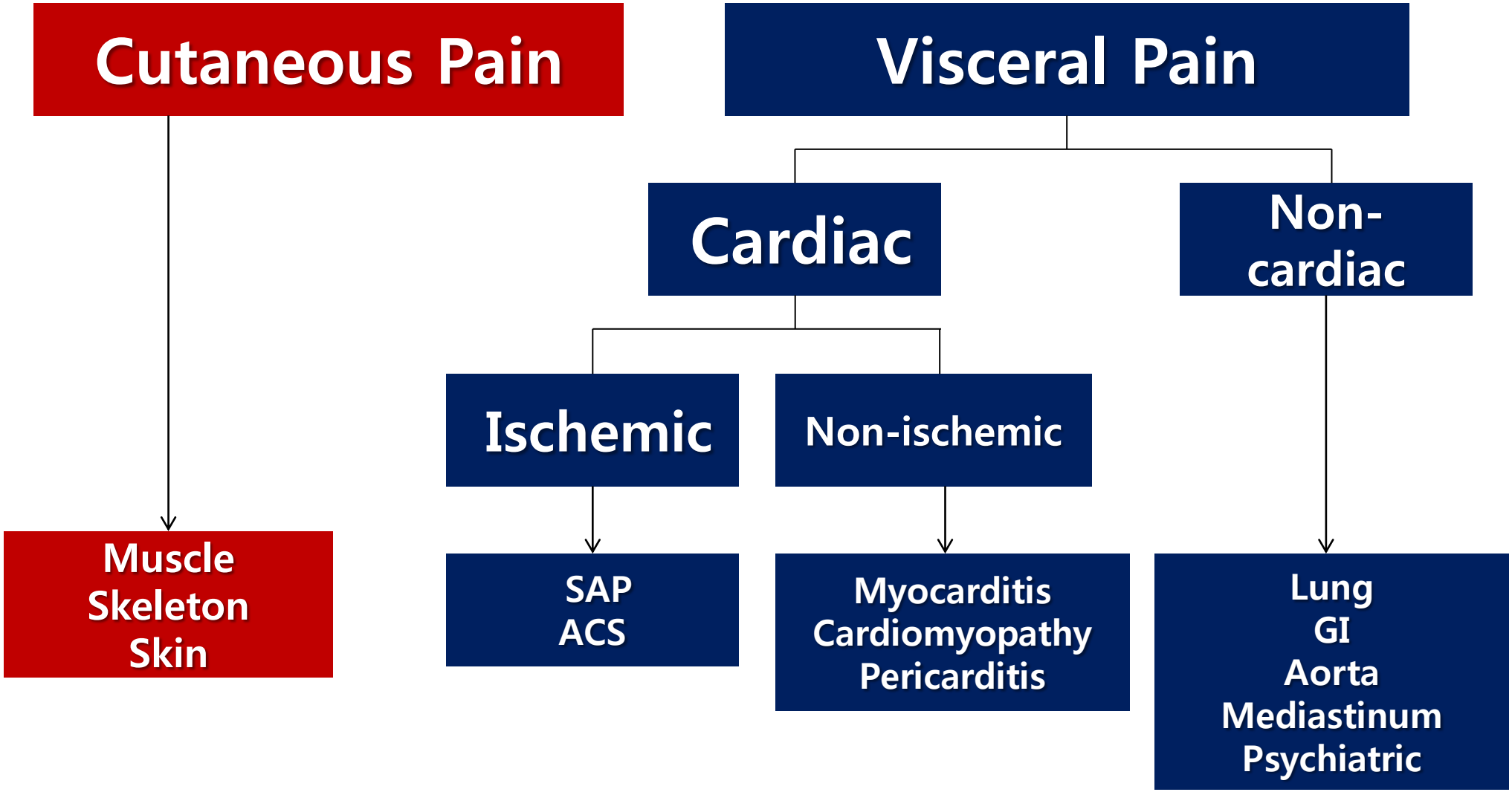
# *Evaluation of Chest Pain: Diagnostic Challenge*

**전남의대**
**순환기내과**

**안영근**

# Cause of Chest Pain



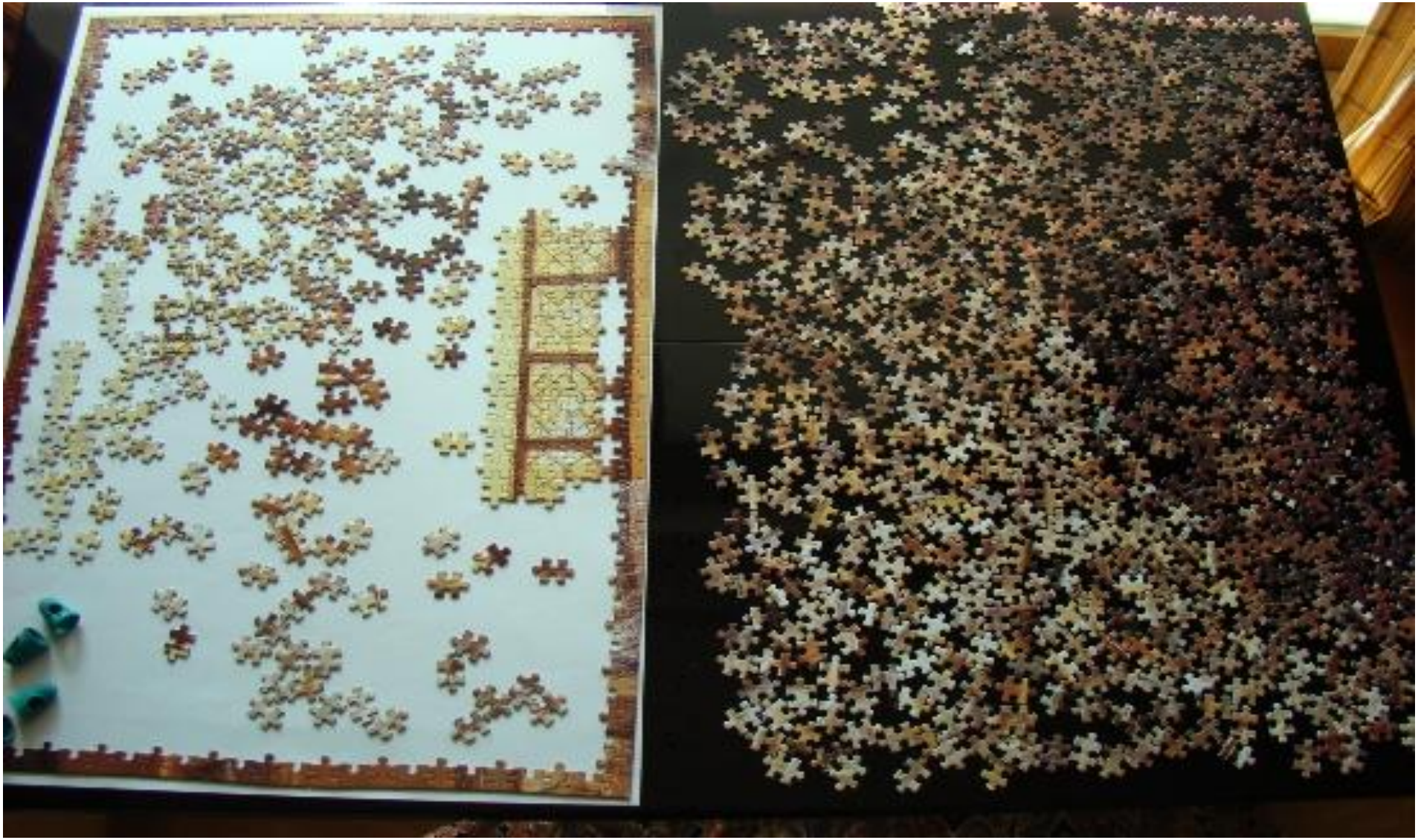

ESC Task Force Report on Chest Pain. Eur Heart J 2002;23:1153-76

# Cause of Chest Pain

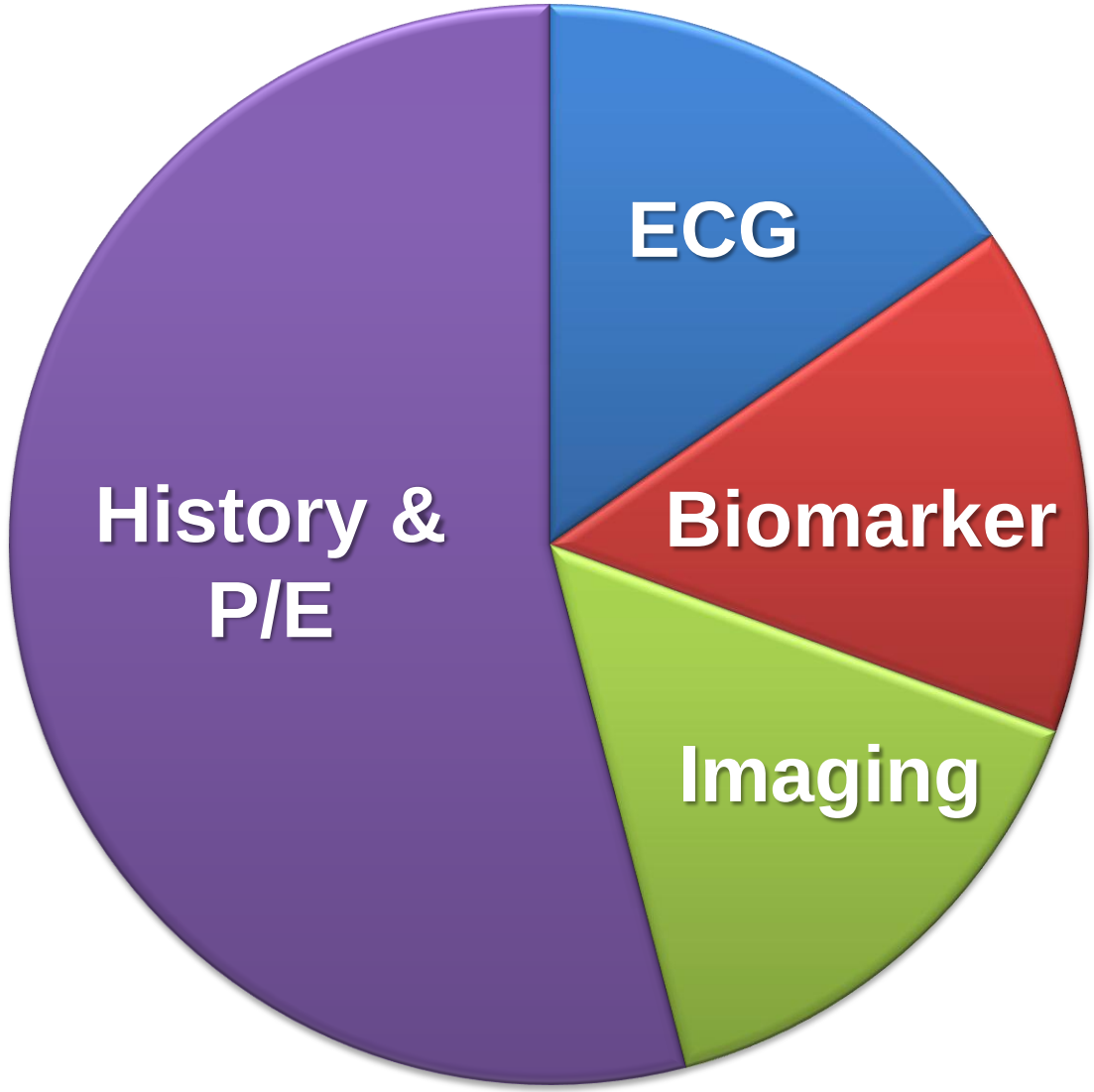
| Etiology | General practitioner | Dispatch center | Ambulance crew | Emergency department |
|---|---|---|---|---|
| Cardiac (%) | 20 | 60 | 69 | 45 |
| Musculoskeletal (%) | 43 | 6 | 5 | 14 |
| Pulmonary (%) | 4 | 4 | 4 | 5 |
| Gastrointestinal (%) | 5 | 6 | 3 | 6 |
| Psychiatric (%) | 11 | 5 | 5 | 8 |
| Others (%) | 16 | 19 | 18 | 26 |

ESC Task Force Report on Chest Pain. Eur Heart J 2002;23:1153-76

# How Can You Approach to Chest Pain?



# Key Factors in Differential Diagnosis of Chest Pain



# Part 1. Stable Chest Pain

# Stable Chest Pain Main Algorithm

**Carry out a clinical assessment**

**Does the person have confirmed coronary artery disease?**

- Treat as SAP
- Exercise ECG
- Non-invasive functional imaging

- Does the person have non-anginal chest pain
  **and**
- Stable angina is not suspected based on history and risk factors?

**Consider other causes of chest pain**

- Does the person have features of typical or atypical angina
  **and**
- Is stable angina suspected based on history and risk factors?

**Estimate the likelihood of CAD**

Merged with 2002 ACC/AHA guideline, 2002 ESC guideline, 2011 NICE guideline

# 1st step : History

1. • Characteristics of the chest pain
2. • Associated Sx
3. • Cardiovascular risk factors

# 1. Characteristics of chest pain

| | |
|---|---|
| Quality | • Typically squeezing, griplike, pressurelike, suffocating, heavy<br>• Never sharp or stabbing<br>• Do not change with position or respiration |
| Location | • Usually substernal<br>• Radiating to the neck, jaw, epigastrium, arm: common<br>• Pain above mandible, below epigastrium, localized to small area: not likely |
| Duration | • Typically minutes<br>• Fleeting discomfort or dull ache lasting for hours: not likely |
| Provoking factor | • Exertion, emotional stress |
| Relieving factor | • Rest, SL NTG |

# 1. Characteristics of chest pain

- **Factors making stable angina more likely:**
  - increasing age
  - whether the person is male
  - cardiovascular risk factors
  - a history of established CAD (e.g. previous MI, coronary revascularization)

**Vs.**

- **Stable angina is unlikely if the pain is:**
  - continuous or very prolonged and/or
  - unrelated to activity and/or
  - brought on by breathing in and/or
  - associated with dizziness, palpitations, tingling or difficult swallowing

# 1. Characteristics of chest pain

## Typical angina (Definite)

- Substernal chest discomfort with a characteristic quality and duration
- Provoked by exertion or emotional stress
- Relieved by rest or NTG

## Atypical angina (Probable)

- Meets 2 of the above chracteristics

## Non-cardiac chest pain

- Meets one or none of the typical anginal characteristics

2002 ACC/AHA Practice Guideline for CSAP

# 2. Associated Features

**Autonomic nervous Sx**

Pale, Diaphoretic, Cool to touch, Nausea, Vomiting

**Pulmonic Sx**

Dyspnea, Tachypnea, Pleuritic pain, Fever, rales

**Increased venous Pressure sign**

Edema, Jugular venous distension

Frequently Cardiac origin

Positional change

Response to medication: NTG, antacid

Response to food

# 3. Risk factors of CAD

- Smoking
- Hyperlipidemia
- Diabetes
- Hypertension
- Family history of premature CAD
- Prior history of CVD and PVD

# 2nd step : Physical Examination

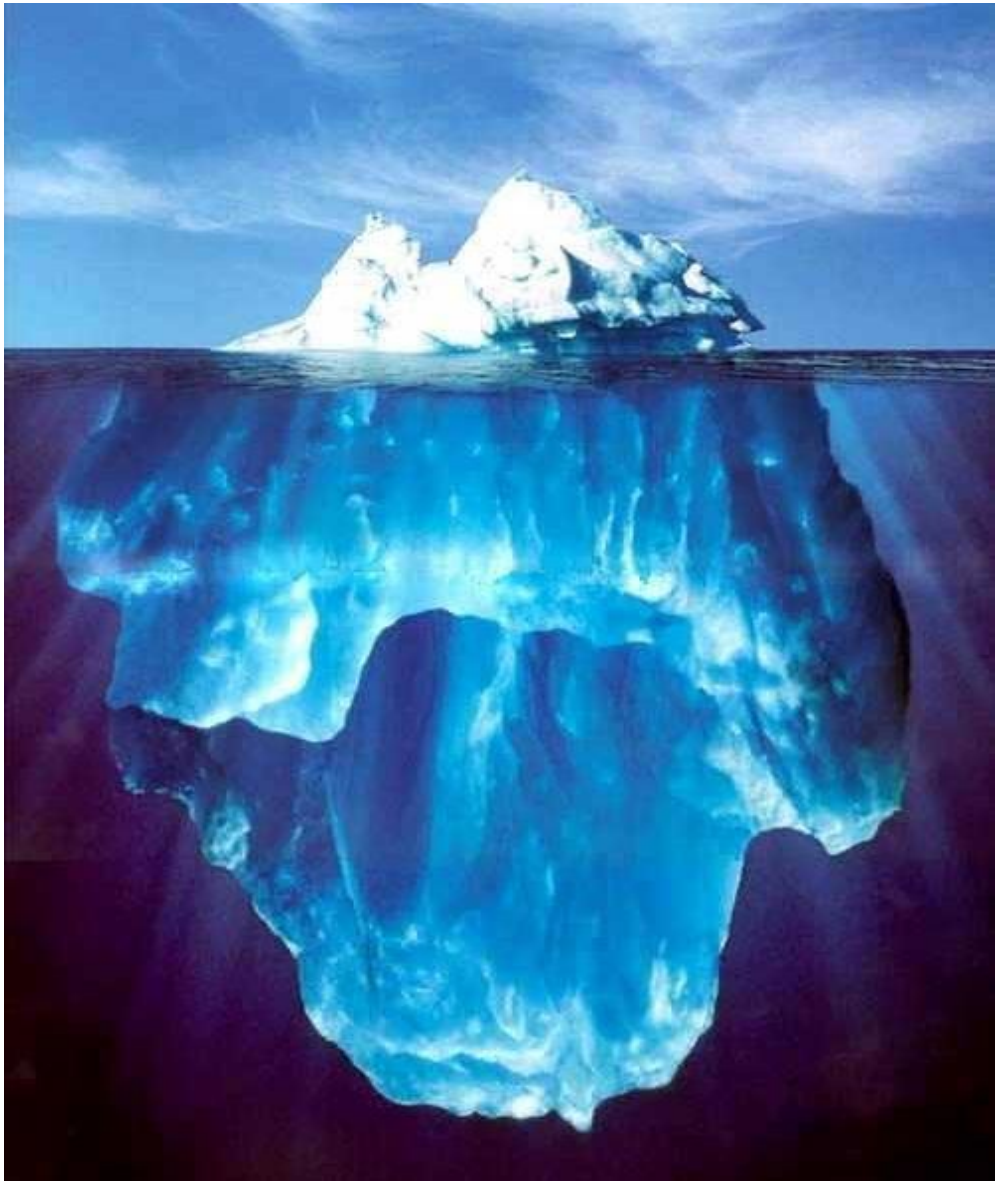
**Predictive of CAD**

- S3, S4, gallop, MR murmur, paradoxically split of S2
- Bibasilar rales or chest wall heave
- Non-coronary atherosclerotic disease => carotid bruit, diminished pedal pulse, abdominal aneurysm
- Elevated BP, Xanthoma, Retinal exudate

**Against of CAD**

- Tender areas revealed by palpitation of chest wall => musculoskeletal chest wall syndrome
- Presence of rub => pericardial or pleural disease

# 3rd step : ECG



Abnormal ECG

Normal ECG

# 3rd step : ECG

**Predictive of CAD**

- Evidence of LVH or ST-T wave change
- Prior Q wave MI
- ST segment elevation or depression

**Possible CAD with low specificity**

- Arrhythmia => AF or VT/Vf
- Various degree of AV block
- Left anterior fascicular hemiblock
- RBBB
- LBBB
- Symmetrical T wave inversion

# 4th step : Estimation of likelihood of CAD

**Table 1 Percentage of people estimated to have coronary artery disease according to typicality of symptoms, age, sex and risk factors[2]**

| Age (years) | Non-anginal chest pain | | | | Atypical angina | | | | Typical angina | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Men | | Women | | Men | | Women | | Men | | Women | |
| | Lo | Hi | Lo | Hi | Lo | Hi | Lo | Hi | Lo | Hi | Lo | Hi |
| 35 | 3 | 35 | 1 | 19 | 8 | 59 | 2 | 39 | 30 | 88 | 10 | 78 |
| 45 | 9 | 47 | 2 | 22 | 21 | 70 | 5 | 43 | 51 | 92 | 20 | 79 |
| 55 | 23 | 59 | 4 | 25 | 45 | 79 | 10 | 47 | 80 | 95 | 38 | 82 |
| 65 | 49 | 69 | 9 | 29 | 71 | 86 | 20 | 51 | 93 | 97 | 56 | 84 |

For men older than 70 with atypical or typical symptoms, assume an estimate > 90%.
For women older than 70, assume an estimate of 61–90% EXCEPT women at high risk AND with typical symptoms where a risk of > 90% should be assumed.

Values are per cent of people at each mid-decade age with significant coronary artery disease (CAD).
Hi = High risk = diabetes, smoking and hyperlipidaemia (total cholesterol > 6.47 mmol/litre).
Lo = Low risk = none of these three.
The shaded area represents people with symptoms of non-anginal chest pain, who would not be investigated for stable angina routinely.
**Note:** These results are likely to overestimate CAD in primary care populations.
If there are resting ECG ST-T changes or Q waves, the likelihood of CAD is higher in each cell of the table.

**Pryor DB, Shaw L, McCants CB et al. Annals of Internal Medicine. 1993;118:81-90.**
**Adopted to NICE guideline, the management of stable angina. 2011**

# ACC/AHA 2002 guideline for exercise ECG test

| Class | Indication |
|---|---|
| I | Intermediate pretest probability of CAD on the basis of gender, age |
| IIa | Patients with vasospastic angina |
| IIb | High pretest probability of CAD by age, symptoms, and gender |
| | Low pretest probability of CAD by age, symptoms, and gender |
| | less than 1 mm of baseline ST-segment depression and taking digoxin |
| | Complete left bundle branch block |

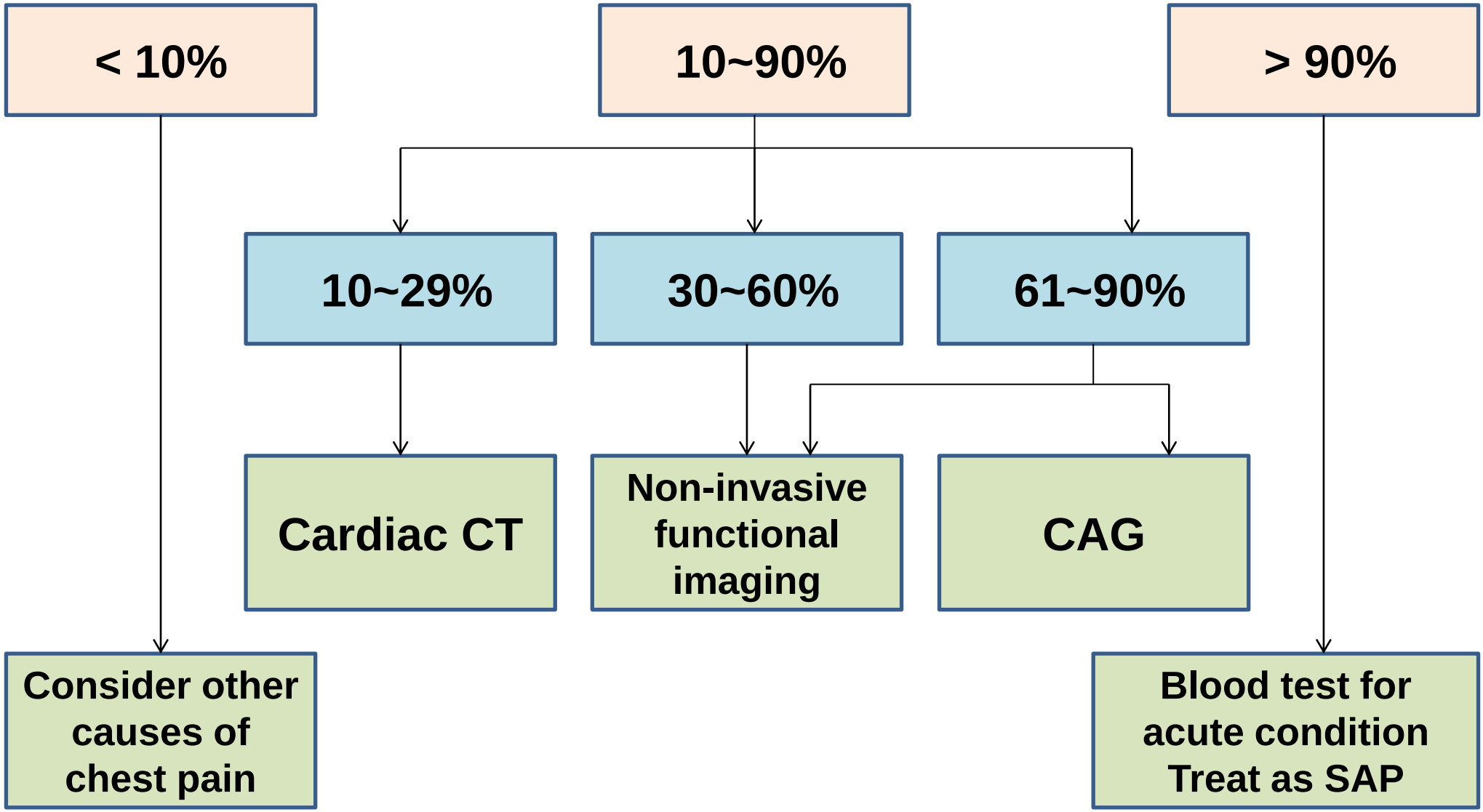
# Pretest Probability of Coronary Artery Disease by Age, Gender and Symptoms

| Age | Gender | Typical or Definite Angina Pectoris | Atypical or Probable Angina Pectoris | Nonanginal Chest Pain | Asymptomatic |
|---|---|---|---|---|---|
| **30-39** | **Men** | Intermediate | Intermediate | Low | Very low |
| | **Women** | Intermediate | Very low | Very low | Very low |
| **40-49** | **Men** | High | Intermediate | Intermediate | Low |
| | **Women** | Intermediate | Low | Very low | Very low |
| **50-59** | **Men** | High | Intermediate | Intermediate | Low |
| | **Women** | Intermediate | Intermediate | Low | Very low |
| **60-69** | **Men** | High | Intermediate | Intermediate | Low |
| | **Women** | High | Intermediate | Intermediate | Low |

**High =>90%, Intermediate = 10-90%, Low =< 10%, Very Low =< 5%**

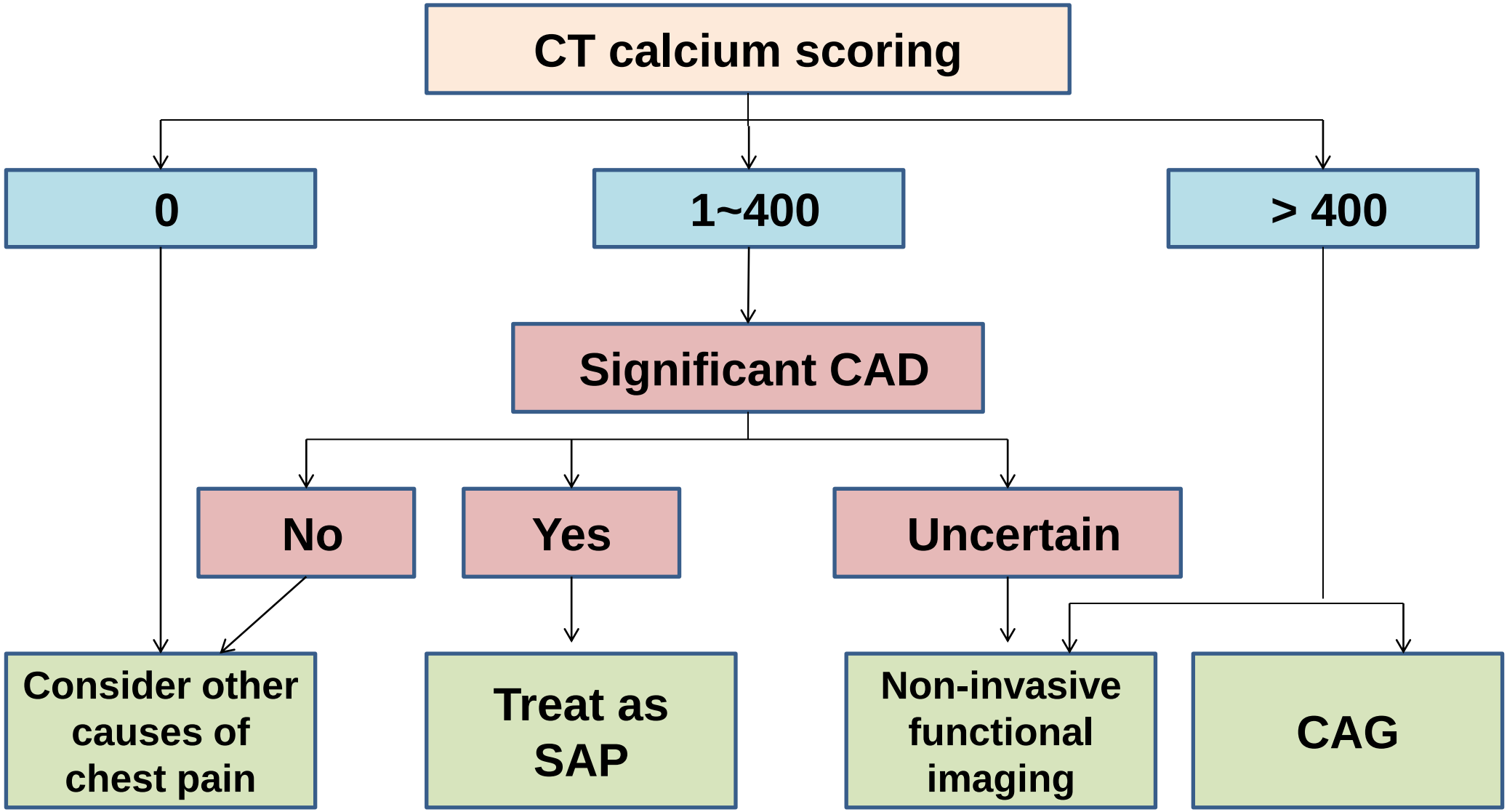
**Braunwald's Heart Disease 9th edition p.193**

# 4th step : Estimation of likelihood of CAD



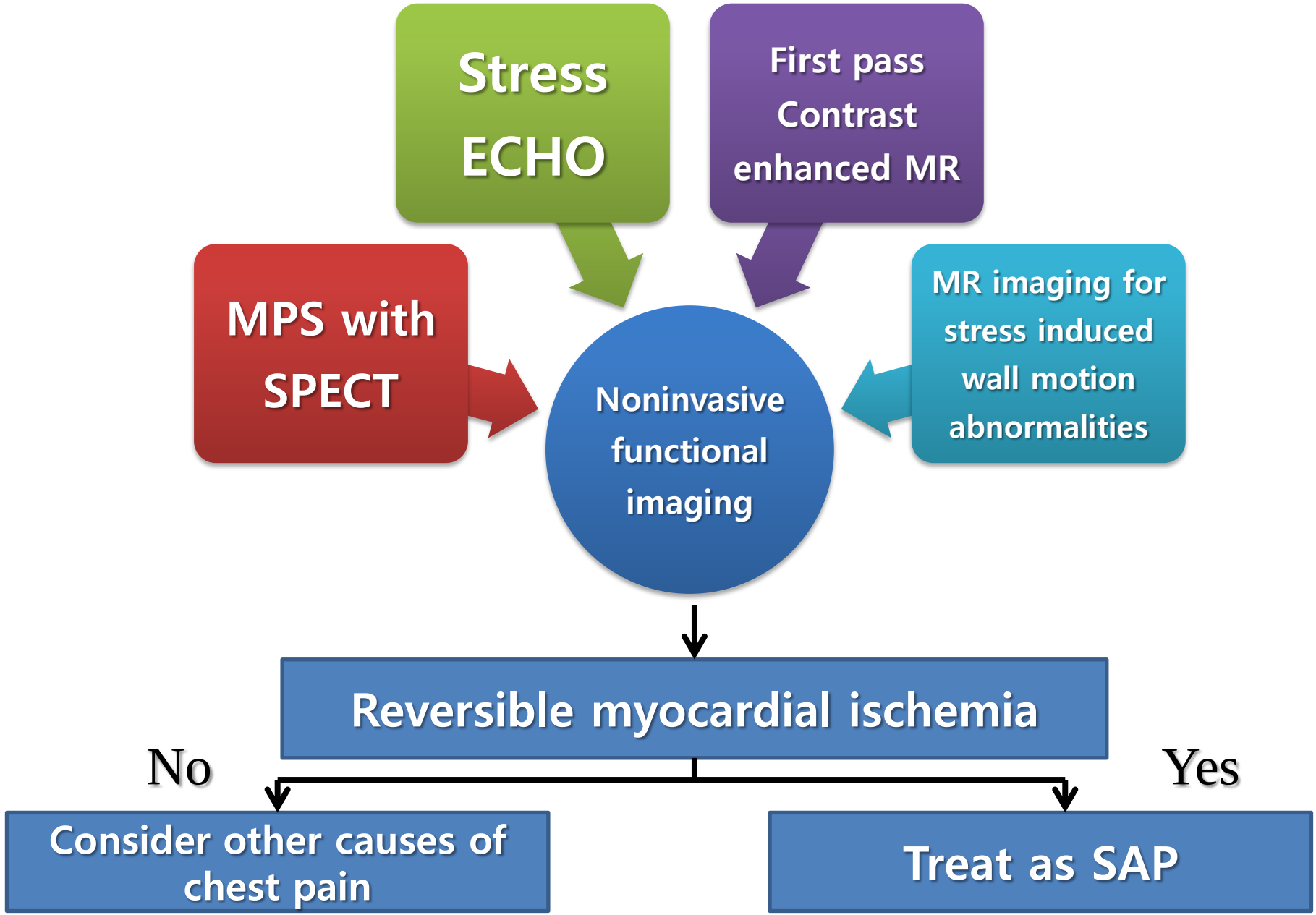

NICE guideline, the management of stable angina. 2011

# Low Risk (<30%) : Cardiac CT

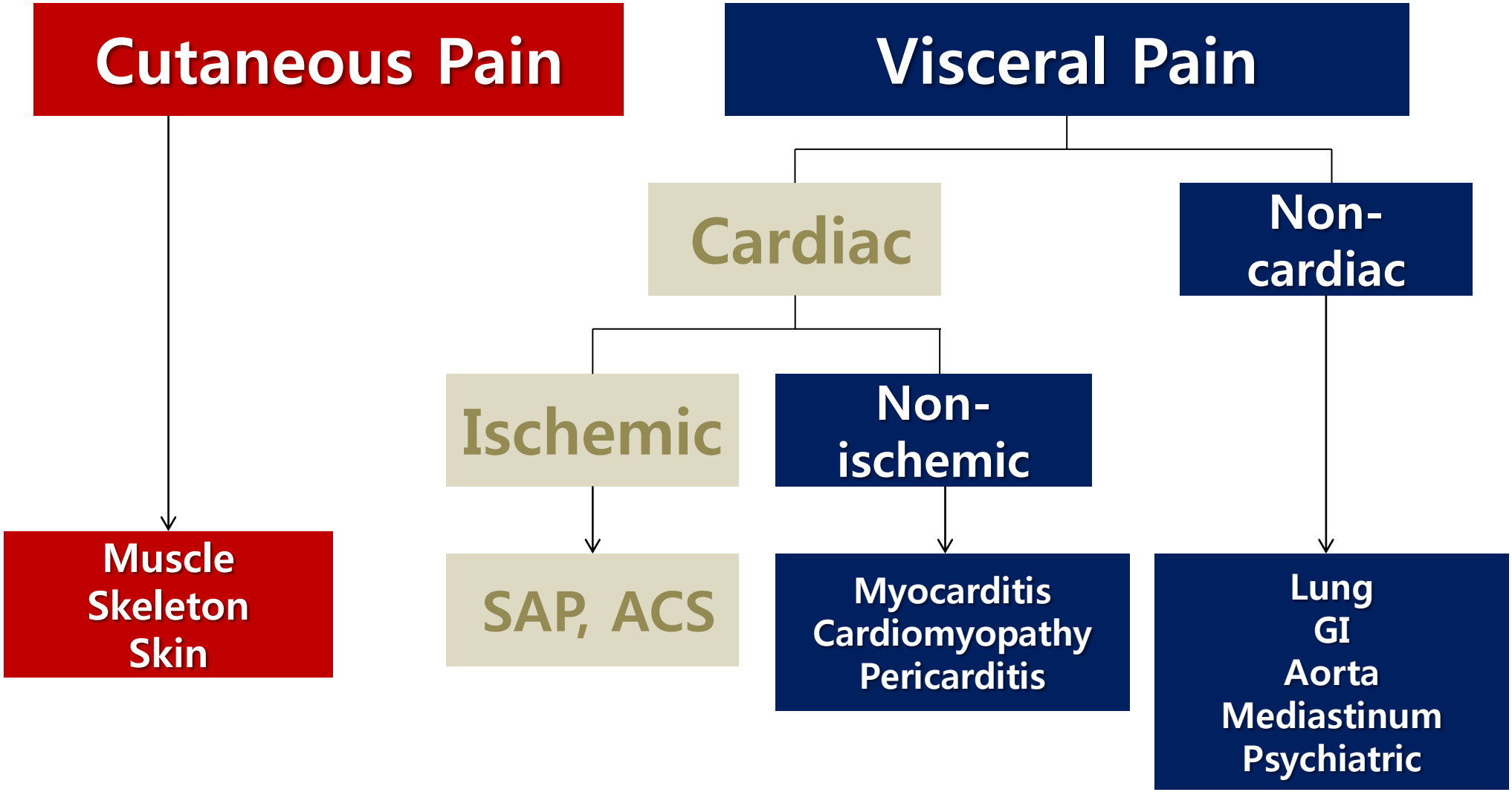



NICE guideline, the management of stable angina. 2011

# Intermediate Risk (30~60%) : Non-invasive Functional Imaging



# Other causes of chest pain




ESC Task Force Report on Chest Pain. Eur Heart J 2002;23:1153-76

# Other causes of chest pain : musculoskeletal

| | Duration | Quality | Location | Associated features |
|---|---|---|---|---|
| Musculo-skeletal disease | Variable | Aching | Variable | Aggravated by movement<br><br>Reproduced by localized pressure on examination |

Fauci AS et al. Harrison 17th 2007

# Other causes of chest pain : Cardiac-non ischemic

| | Duration | Quality | Location | Associated features |
|---|---|---|---|---|
| Aortic stenosis | Recurrent episode like angina | Like angina | Like angina | Late peaking systolic murmur radiating to carotid arteries |
| Pericarditis | Hours to days | Sharp | Retrosternal or toward cardiac apex; may radiate to Lt. shoulder | Relieved by sitting up and leaning forward<br>Pericardial friction rub |
| Aortic dissecton | Abrupt onset | Tearing or ripping knifelike | Ant. chest, radiating to back between shoulder blades | Asso.with HTN/connective tissue disorder<br>AR murmur<br>Pericardial rub<br>Pericardial tamponade |

Fauci AS et al. Harrison 17th 2007

# Other causes of chest pain : Pulmonary

| | Duration | Quality | Location | Associated features |
|---|---|---|---|---|
| PTE | Abrupt onset; Several min to hours | Pleuritic | Lateral; on the side of embolism | Dyspnea, tachypnea, hypotension |
| Pul. HTN | Variable | Pressure | Substernal | Dyspnea, signs of IVP elevation; edema, jugular venous distension |
| Pneumonia | Variable | Pleuritic | Unilateral, often localized | Dyspnea, cough, fever, rales, rub |
| Pneumo-thorax | Sudden onset; several hours | pleuritic | Lateral to side of pneumothorax | Dyspnea, decreased breathing sound on side of pneumothorax |

Fauci AS et al. Harrison 17th 2007

# Other causes of chest pain : GI

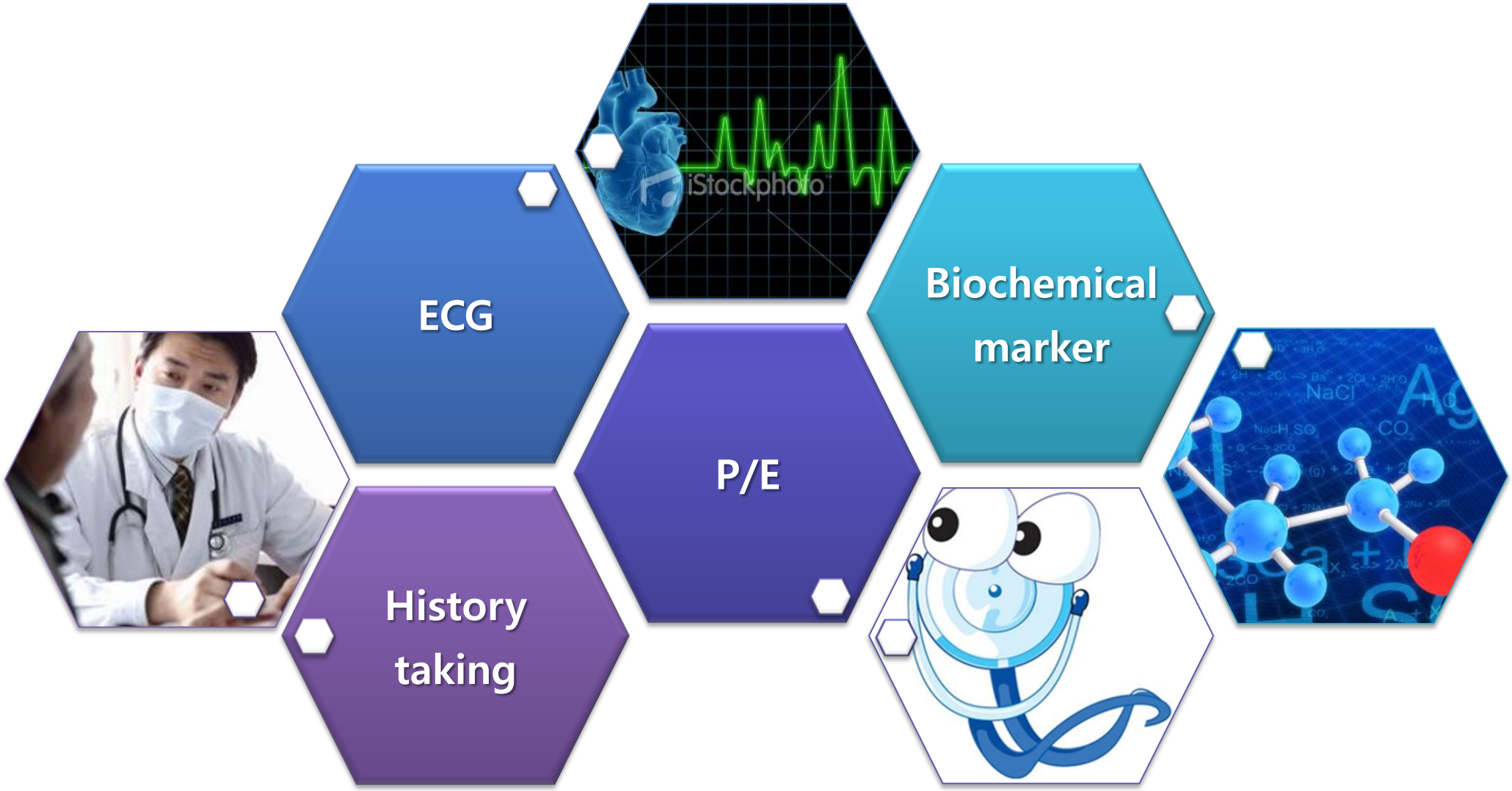
| | Duration | Quality | Location | Associated features |
|---|---|---|---|---|
| GERD | 10-60 min | burning | Substernal; epigastric | Worsened by postprandial recumbency; Relieved by antacids |
| Esophageal spasm | 2-30 min | Pressure Tightness Burning | Retrosternal | Angina like |
| Peptic ulcer | Prolonged | Burning | Substernal; epigastric | Relieved by food or antacids |
| GB disease | Prolonged | Burning Pressure | Epigastric; RUQ; Substernal | Follow meal |

Fauci AS et al. Harrison 17th 2007

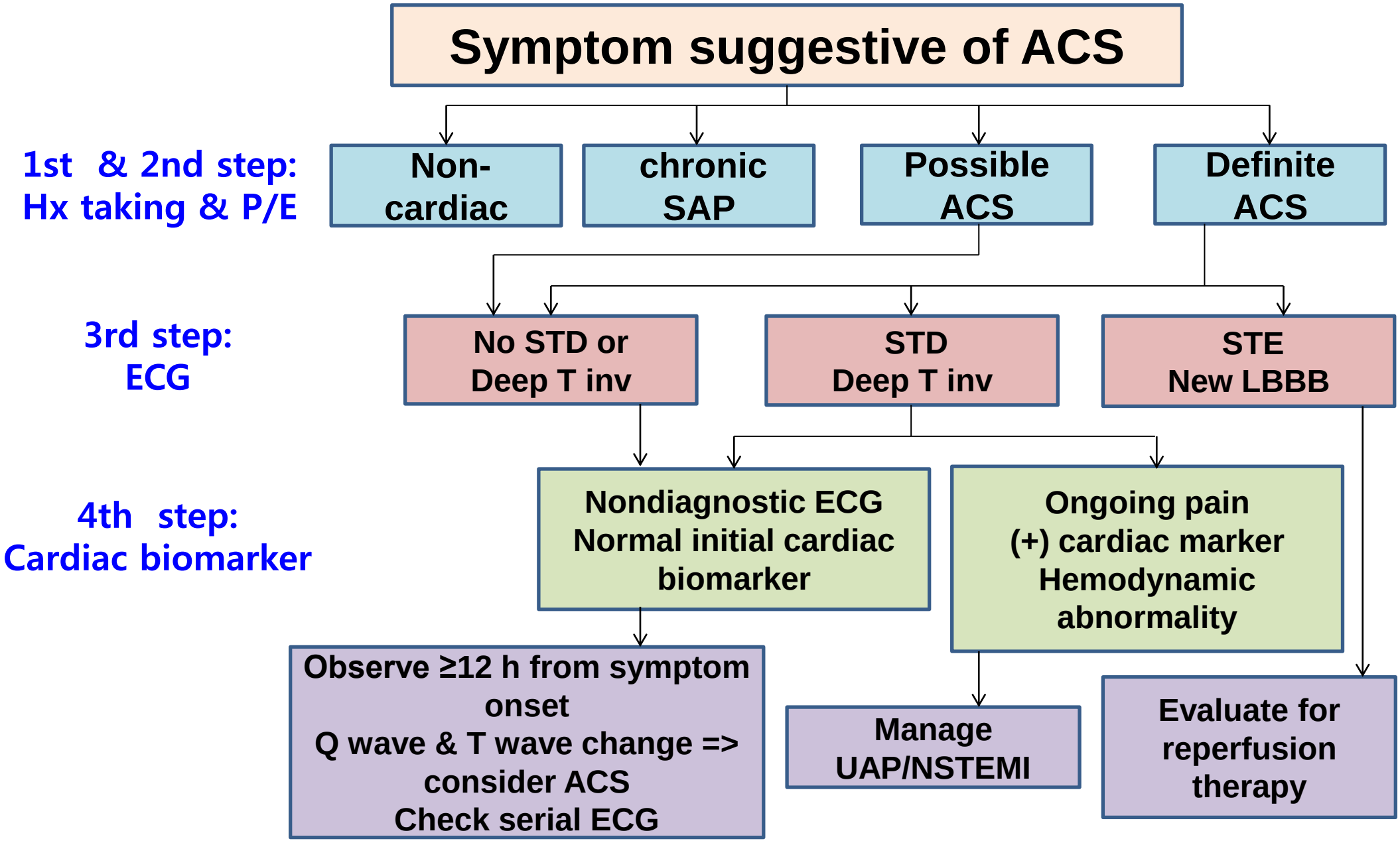
# Part 2. Acute Chest Pain

**Merged with**
**2009 ACC/AHA STEMI guideline,**
**2007 ACC/AHA UAP/NSTEMI guideline,**
**2011 ESC UAP/NSTEMI guideline,**
**2010 NICE UAP/NSTEMI guideline,**
**2010 NICE chest pain on recent onset guideline**

# Initial Assessment of Acute Chest Pain



# Acute Chest Pain : Main algorithm



# 1st step : History Taking

Vs.

Vs.

Ischemic

Non-ischemic

Non-cardiac

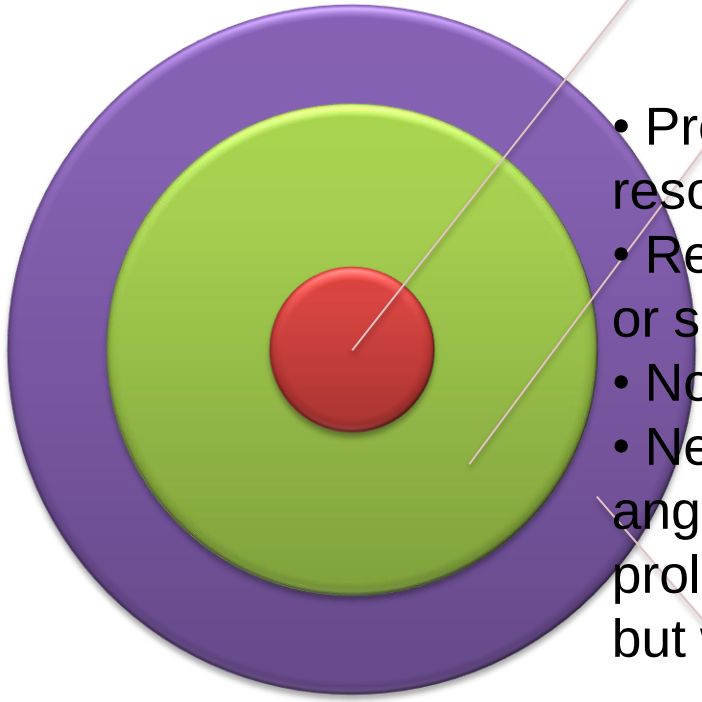
Same D/D focus with SAP

High Risk

Intermediate Risk

Low Risk

# 1st step : History Taking



## High Risk

• Prolonged ongoing (greater than 20 min) rest pain

## Intermediate Risk

• Prolonged (greater than 20 min) rest angina, now resolved, with moderate or high likelihood of CAD
• Rest angina (greater than 20 min) or relieved with rest or sublingual NTG
• Nocturnal angina
• New-onset or progressive CCS class III or IV angina in the past 2 weeks without prolonged (greater than 20 min) rest pain but with intermediate or high likelihood of CAD

## Low Risk

• Increased angina frequency, severity, or duration
• Angina provoked at a lower threshold
• New onset angina with onset 2 weeks to 2 months prior to presentation

**2007 ACC/AHA guideline for UAP/NSTEMI**

# 2nd step : Physical Examination

**Hemodynamic status**

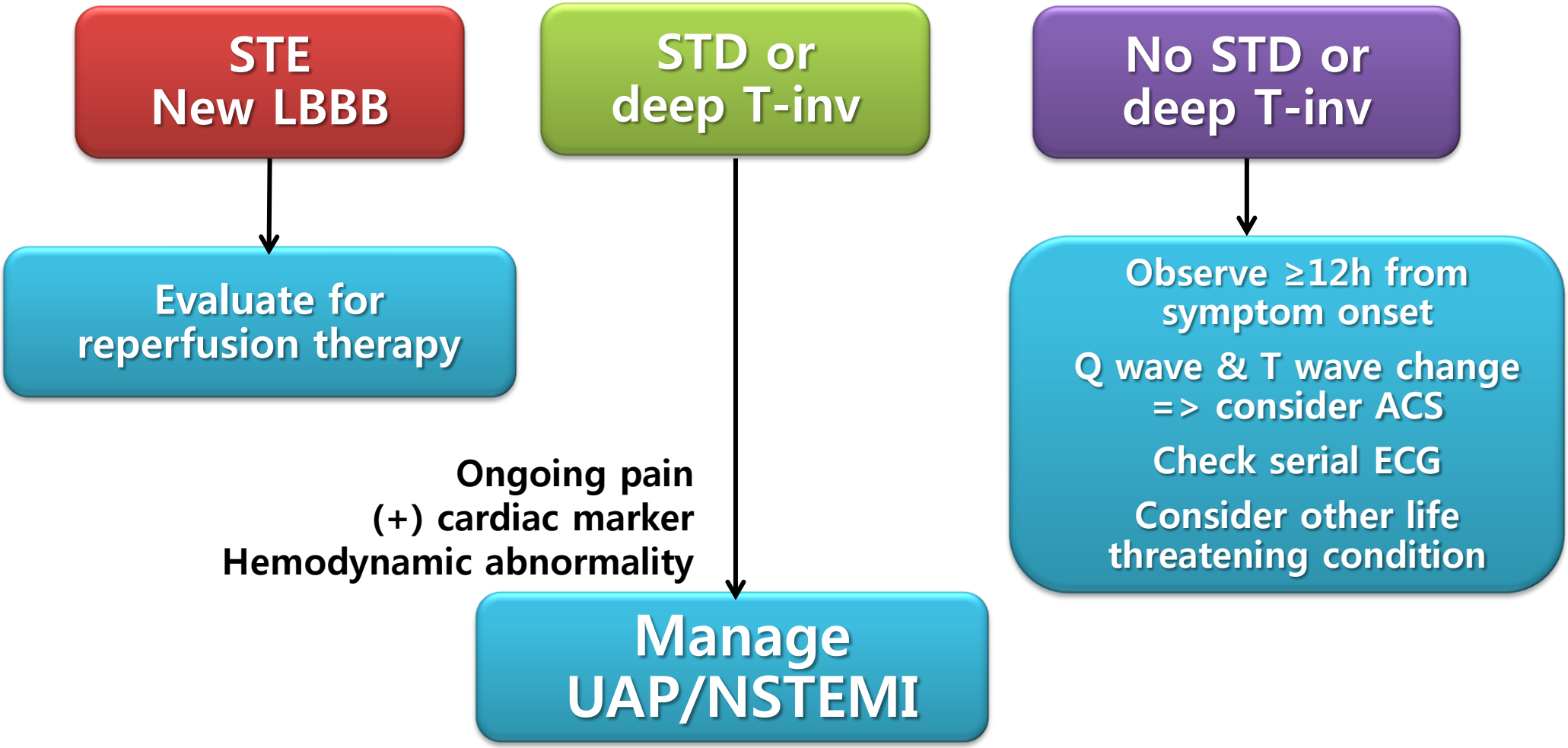
**For signs of complications**

**(e.g. pulmonary edema, cardiogenic shock)**

**For signs of non-coronary causes of acute chest pain**

**(e.g. aortic dissection)**

# 3rd step : ECG




2007 ACC/AHA guideline for UAP/NSTEMI
NICE guideline, chest pain of recent onset. 2010
NICE guideline, unstable angina and NSTEMI. 2010

# 4th step : Biochemical marker

## New definitions of AMI by ESC/AHA

Troponin elevation

+

Ischemic ST or T wave change
New LBBB
New Q wave
PCI related marker elevation
(+) imaging for loss of viable myocardiaum

=

AMI

# 4th step : Biochemical marker


?
=


# Troponin elevation

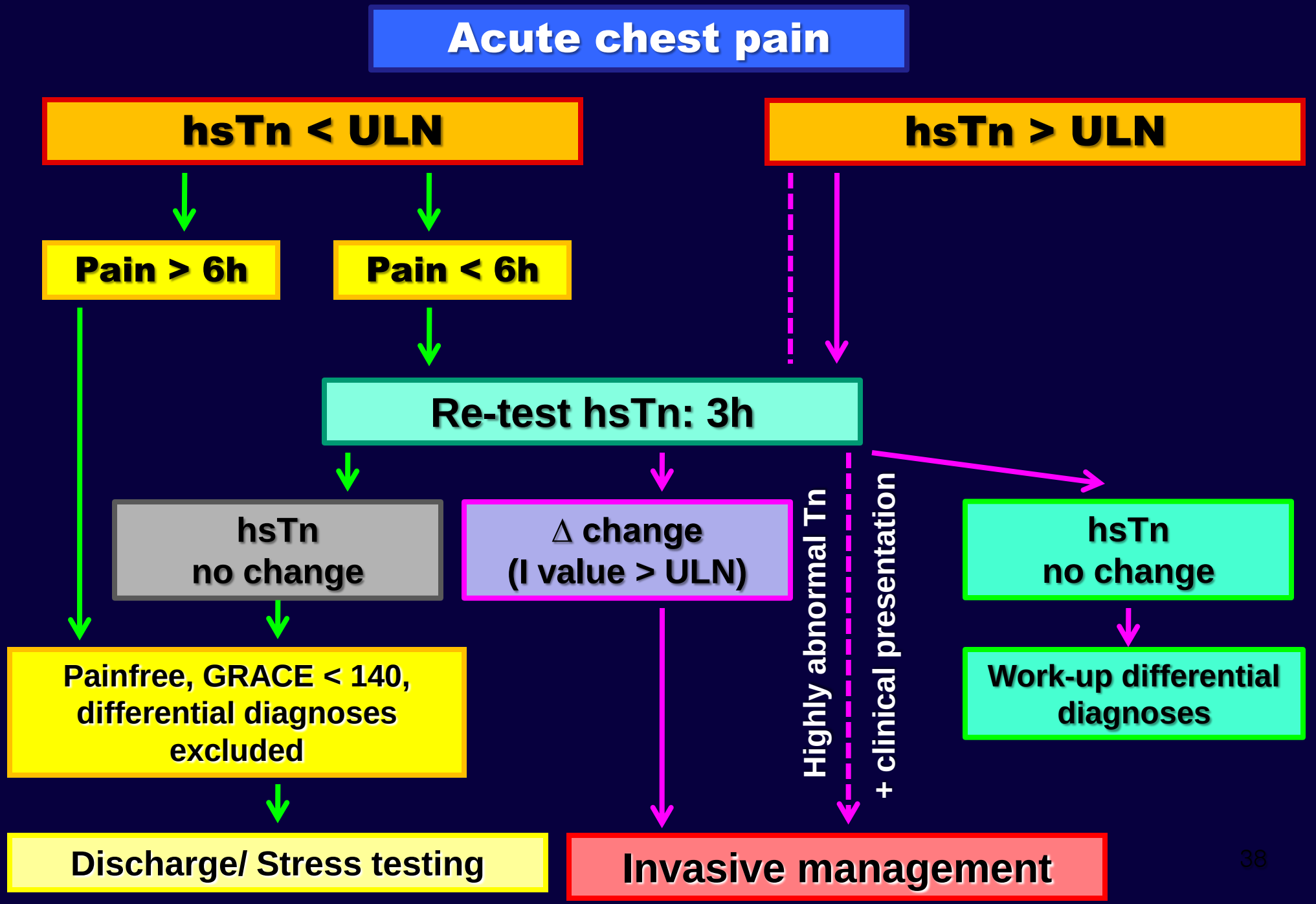
## Non-coronary elevation

- tachyarrhythmia
- Cardiac trauma by intervention
- Chest trauma
- HF
- LVH
- Myocarditis
- Pericarditis

## Non-cardiac elevation

- Sepsis
- Burns
- Respiratory failure
- Acute neurologic disease
- PTE
- Pul. HT
- Drug toxicity
- Cancer chemotherapy
- Renal insufficiency

Galvani M et al. Circulation 1997;95:2053-9


Acute chest pain
hsTn < ULN
hsTn > ULN
Pain > 6h
Pain < 6h
Re-test hsTn: 3h
hsTn
no change
Δ change
(I value > ULN)
Highly abnormal Tn
+ clinical presentation
hsTn
no change
Work-up differential
diagnoses
Painfree, GRACE < 140,
differential diagnoses
excluded
Discharge/ Stress testing
Invasive management