

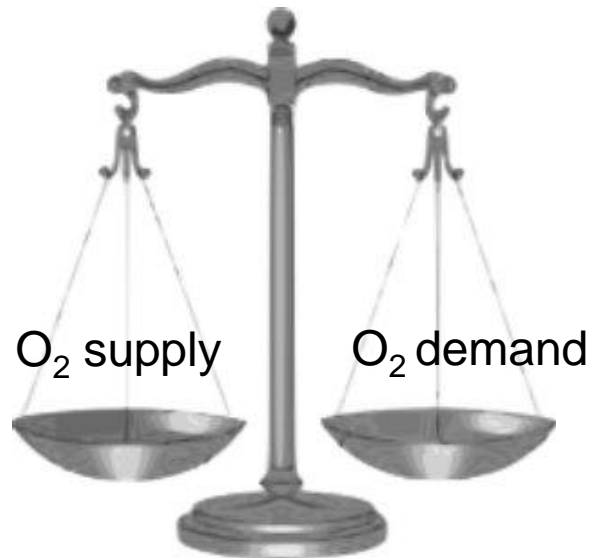
# Ischemic heart disease

- pathogenesis, clinical features, primary & secondary prevention

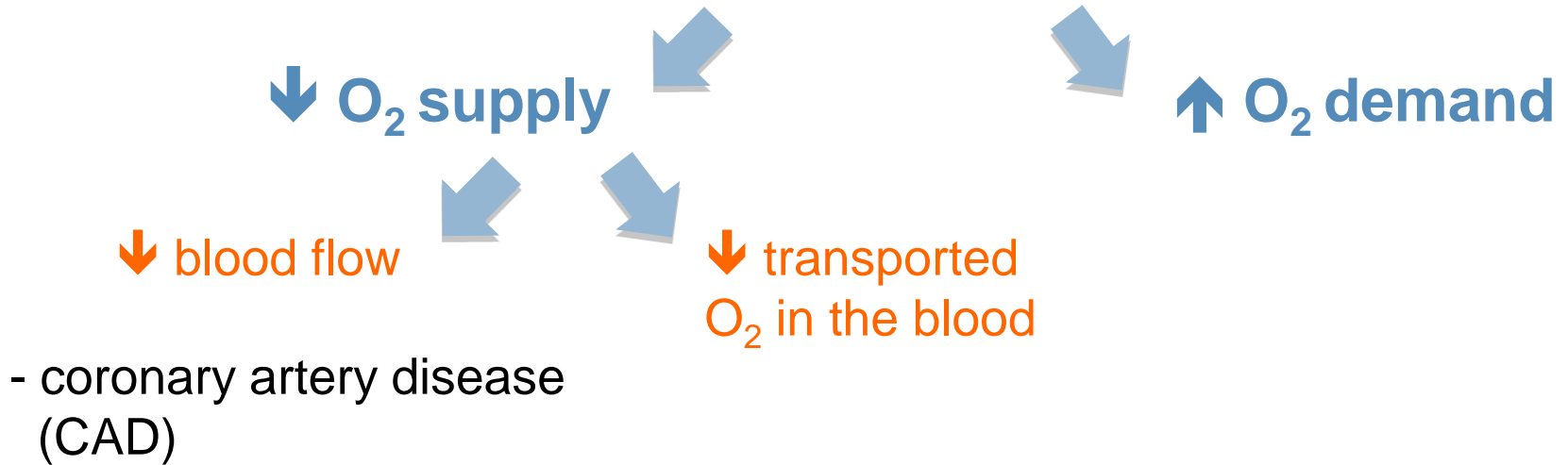
Agnieszka Kapłon-Cieślicka

# Definition

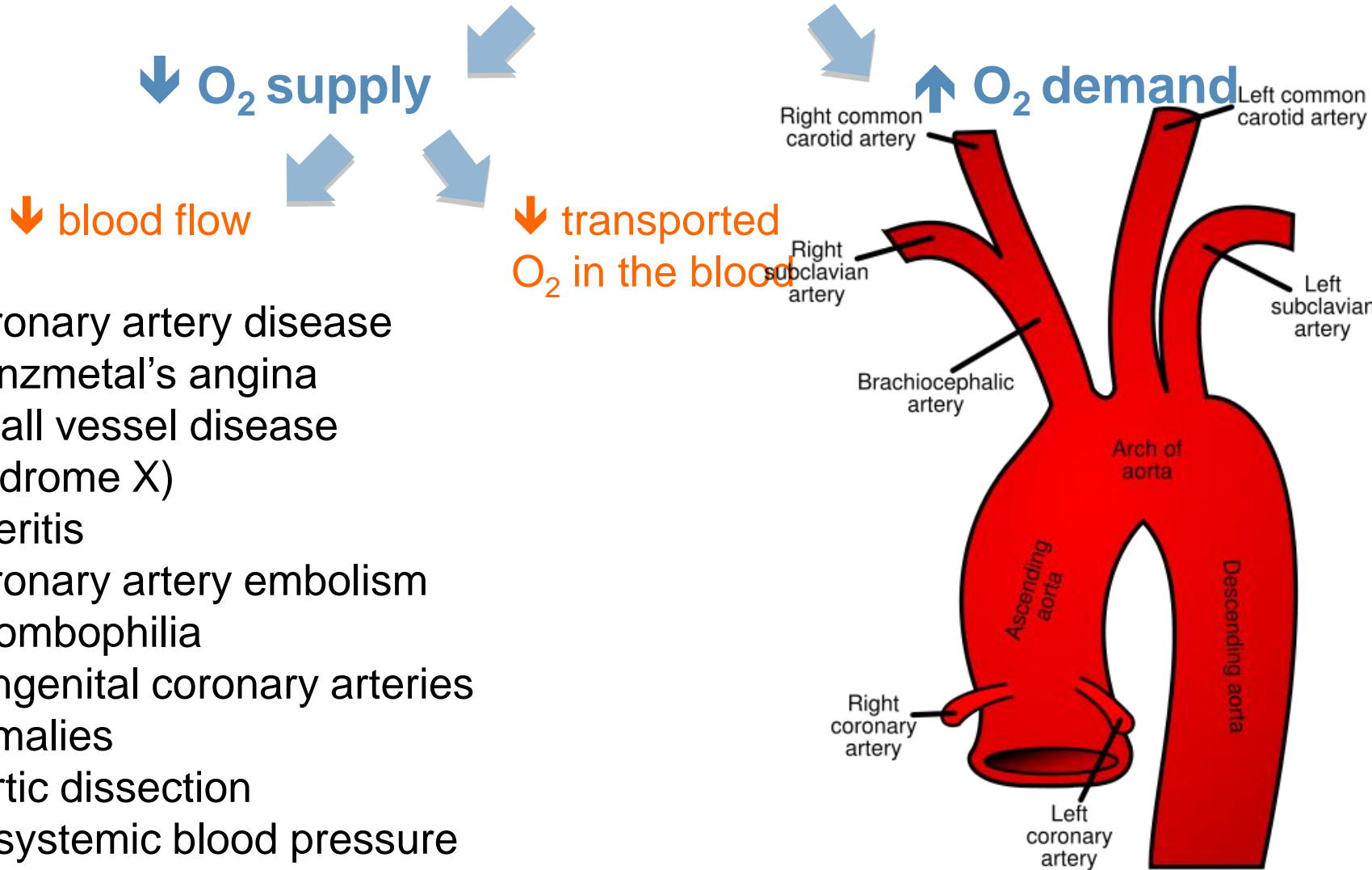
- Ischemic heart disease is ...  
a complex of clinical symptoms of different pathogenesis,  
caused by **insufficient oxygen supply**,  
in comparison with actual **myocardial demands**



# Ischemic heart disease - etiology

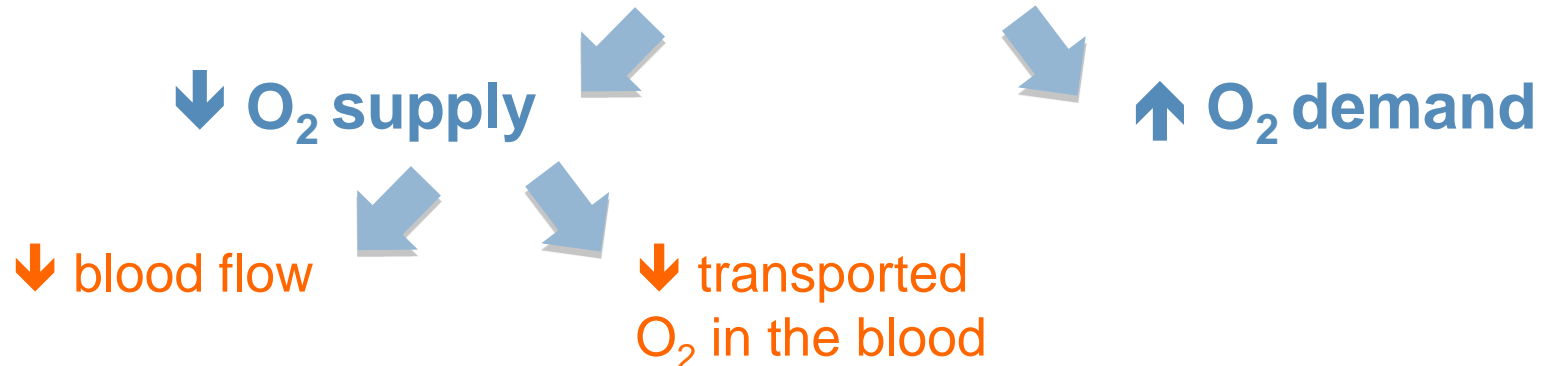


# Ischemic heart disease - etiology



- coronary artery disease
- Prinzmetal's angina
- small vessel disease (syndrome X)
- arteritis
- coronary artery embolism
- thrombophilia
- congenital coronary arteries anomalies
- aortic dissection
- ↓ systemic blood pressure

# Ischemic heart disease - etiology



- coronary artery disease
- Prinzmetal's angina
- small vessel disease (syndrome X)
- arteritis
- coronary artery embolism
- thrombophilia
- congenital coronary arteries anomalies
- aortic dissection
- ↓ systemic blood pressure

- anemia
- carboxy-haemoglobin

# Ischemic heart disease - etiology

↓ O<sub>2</sub> supply

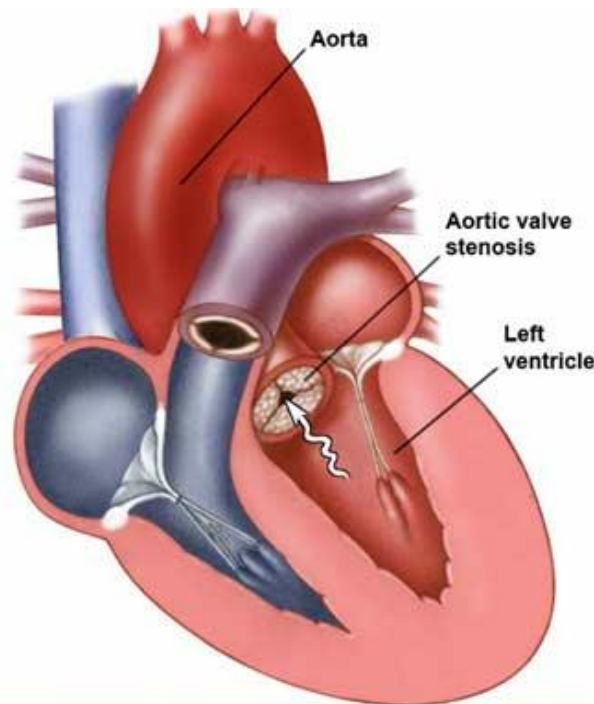
↑ O<sub>2</sub> demand


↓ blood flow

↓ transported  
O<sub>2</sub> in the blood

- coronary artery disease
- Prinzmetal's angina
- small vessel disease (syndrome X)
- arteritis
- coronary artery embolism
- thrombophilia
- congenital coronary anomalies
- aortic dissection
- ↓ systemic blood pressure

- tachycardia
- hyperthyroidism
- aortic stenosis
- hypertrophic cardiomyopathy



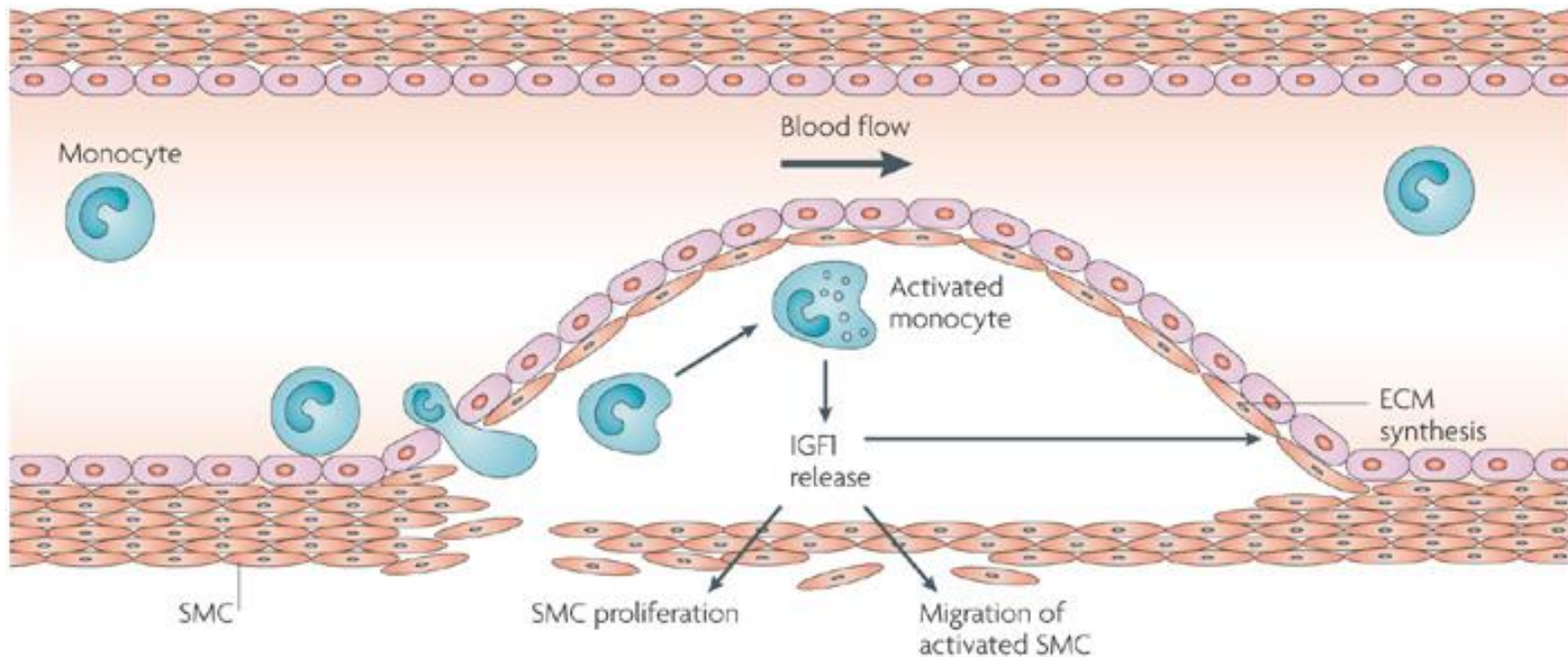


Coronary artery disease -  
- atherosclerosis  
of the coronary arteries

# Pathogenesis of the atherosclerotic plaque

## Endothelium

- **NO (nitric oxide)**
- **PGI<sub>2</sub> (prostacyclin)**

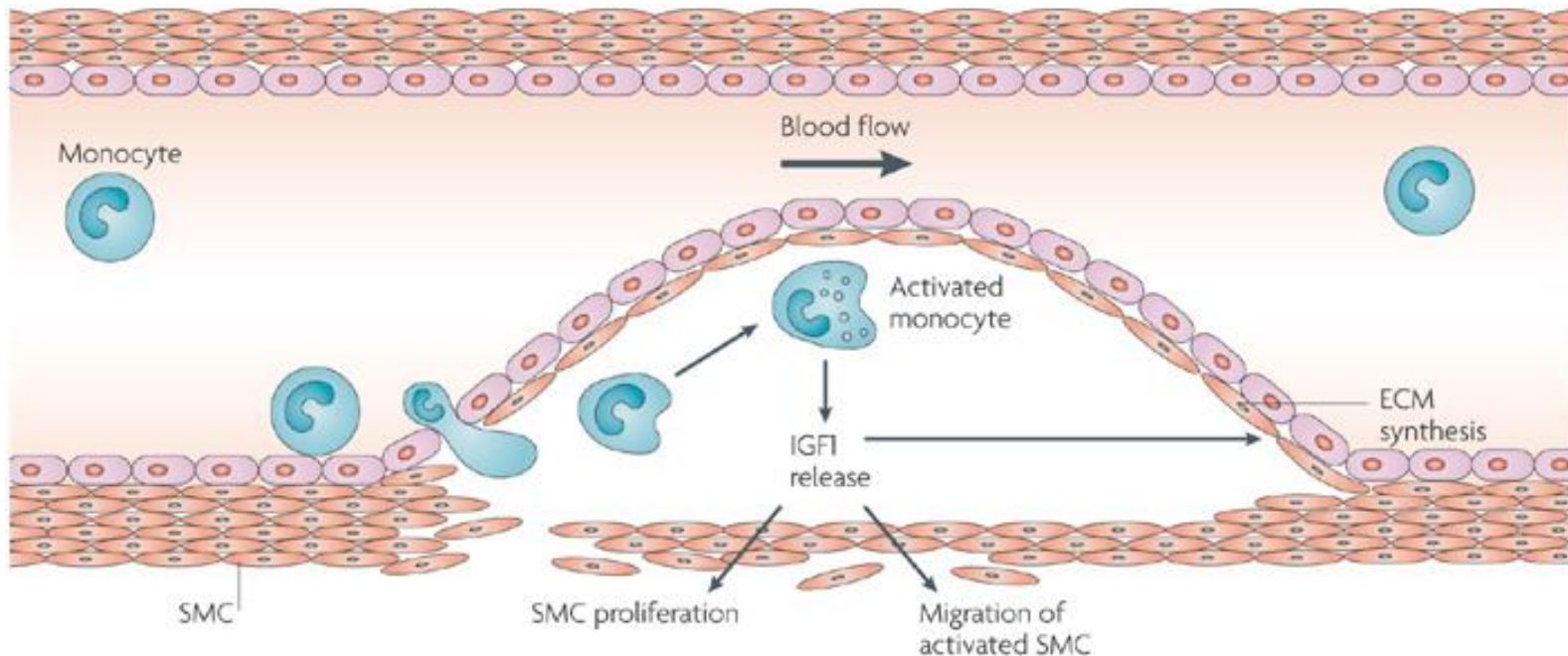




# Pathogenesis of the atherosclerotic plaque

## 1. Stress to the endothelium:

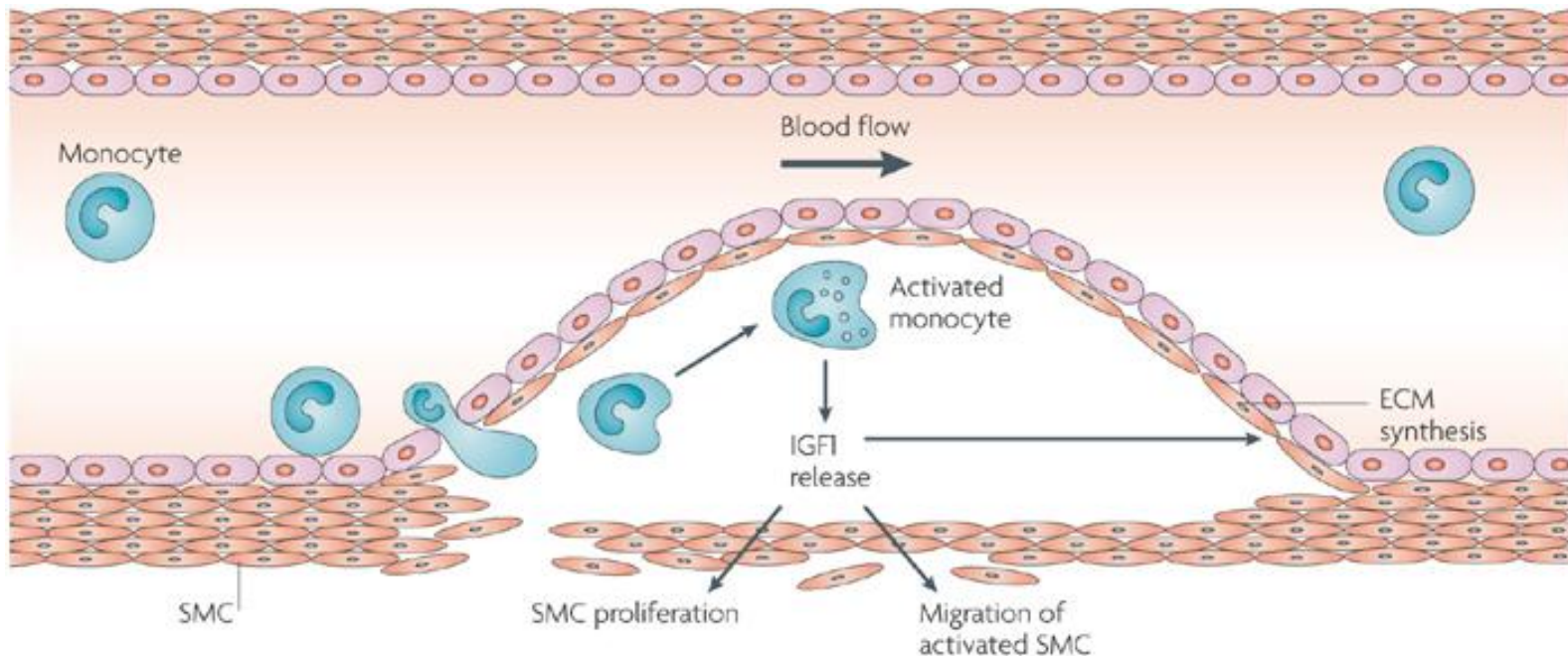
- turbulent blood flow (hypertension)
- oxidative stress:
  - smoking
  - oxidated LDL
  - non-enzymatic glycation (diabetes)



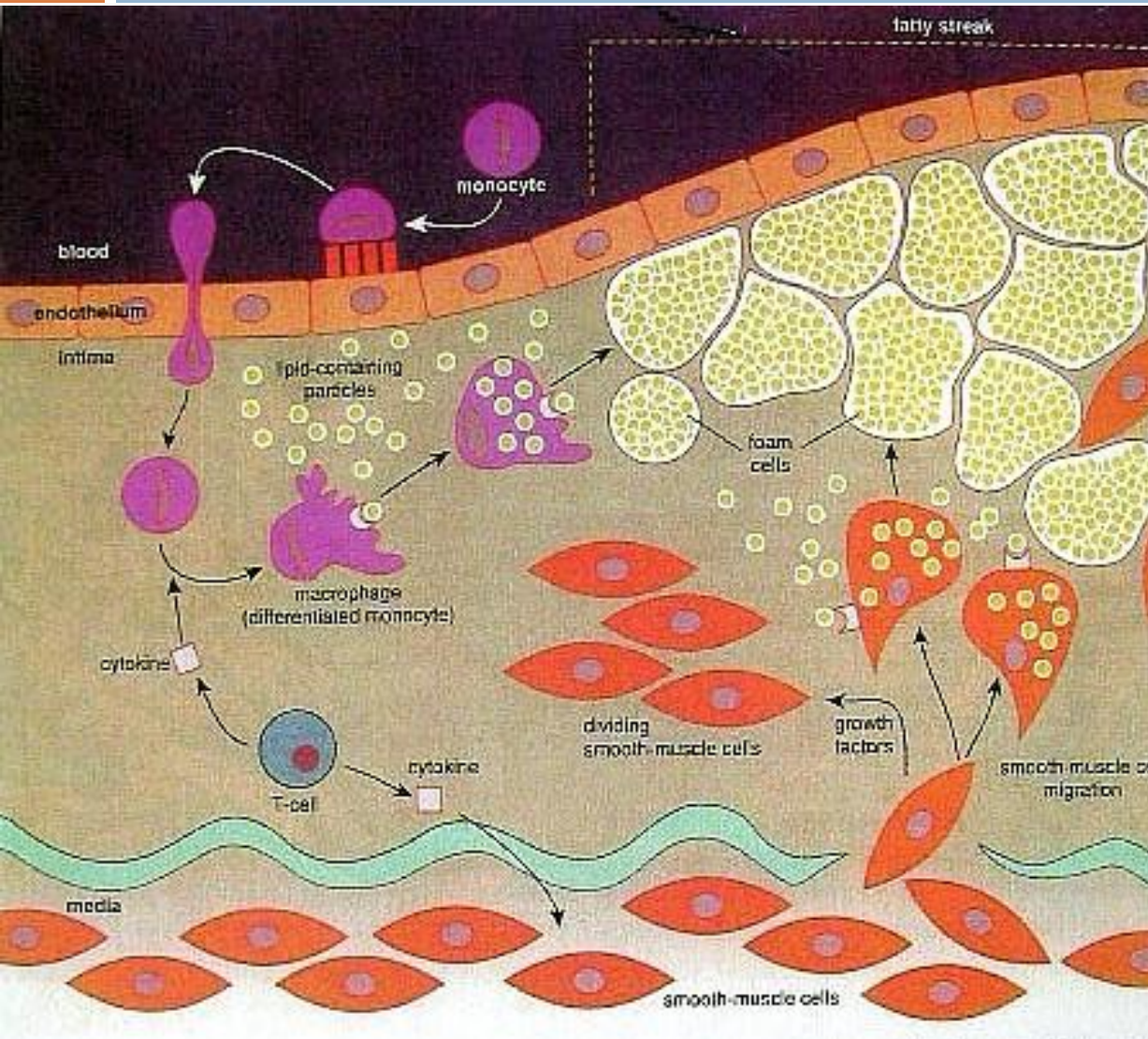
# Pathogenesis of the atherosclerotic plaque

## 2. monocytes migration

monocytes → macrophages + oxy-LDL = "foam cells"



# Pathogenesis of the atherosclerotic plaque



### 3. smooth muscle cell migration and activation

collagen → fibrous cup

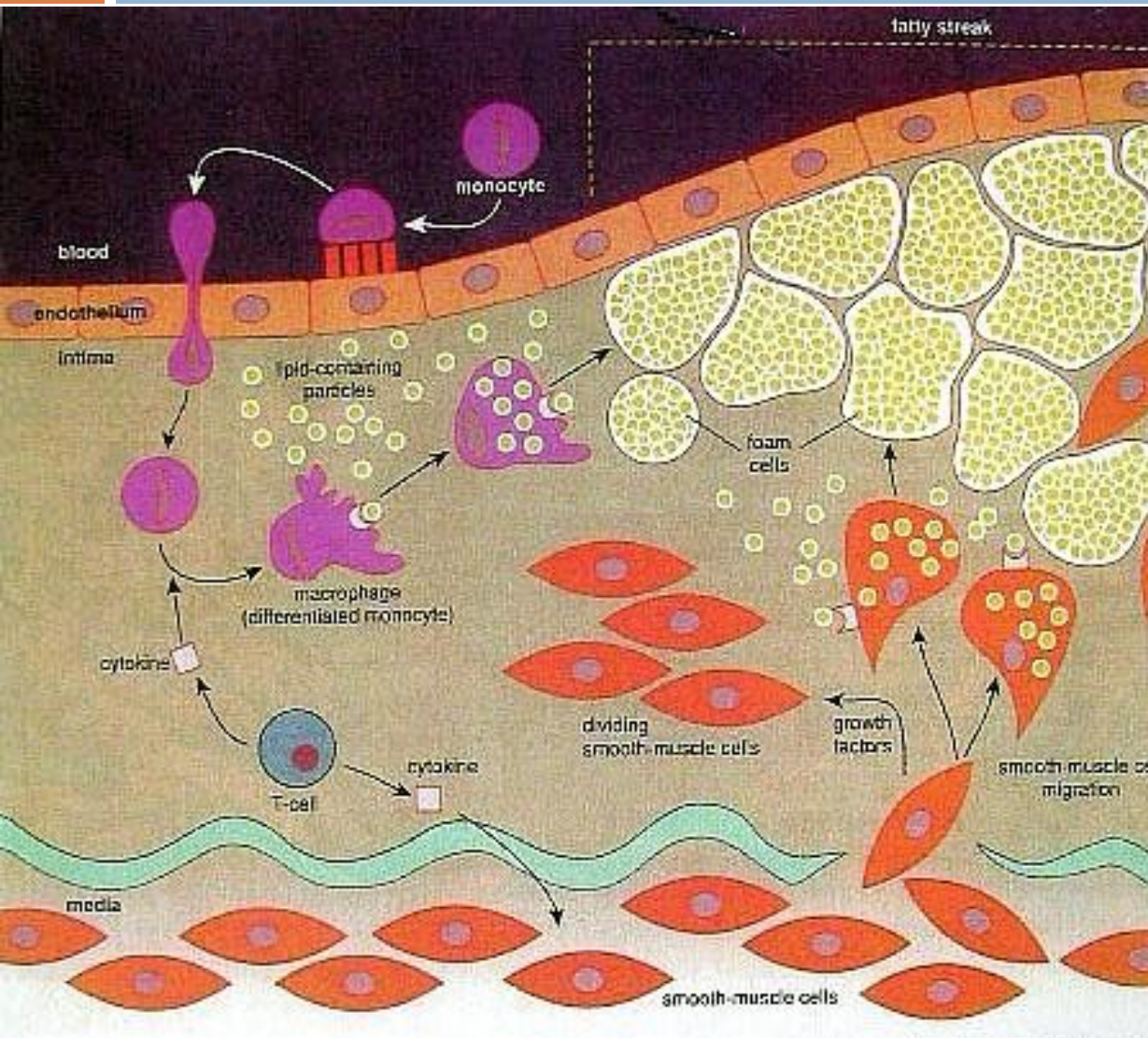
### 4. migration of lymphocytes ...

production of cytokines

atherosclerosis =  
= inflammation

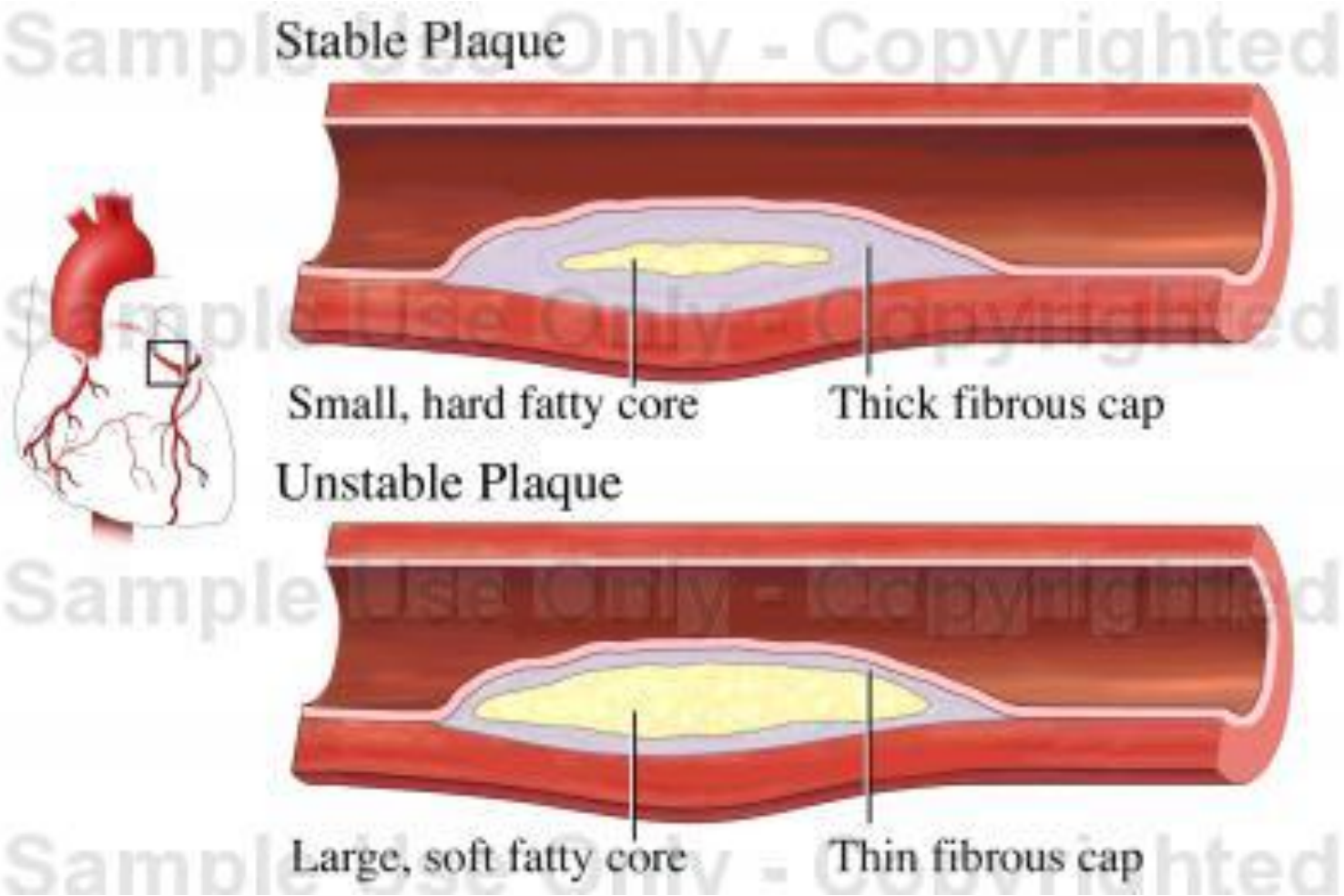


# Pathogenesis of the atherosclerotic plaque

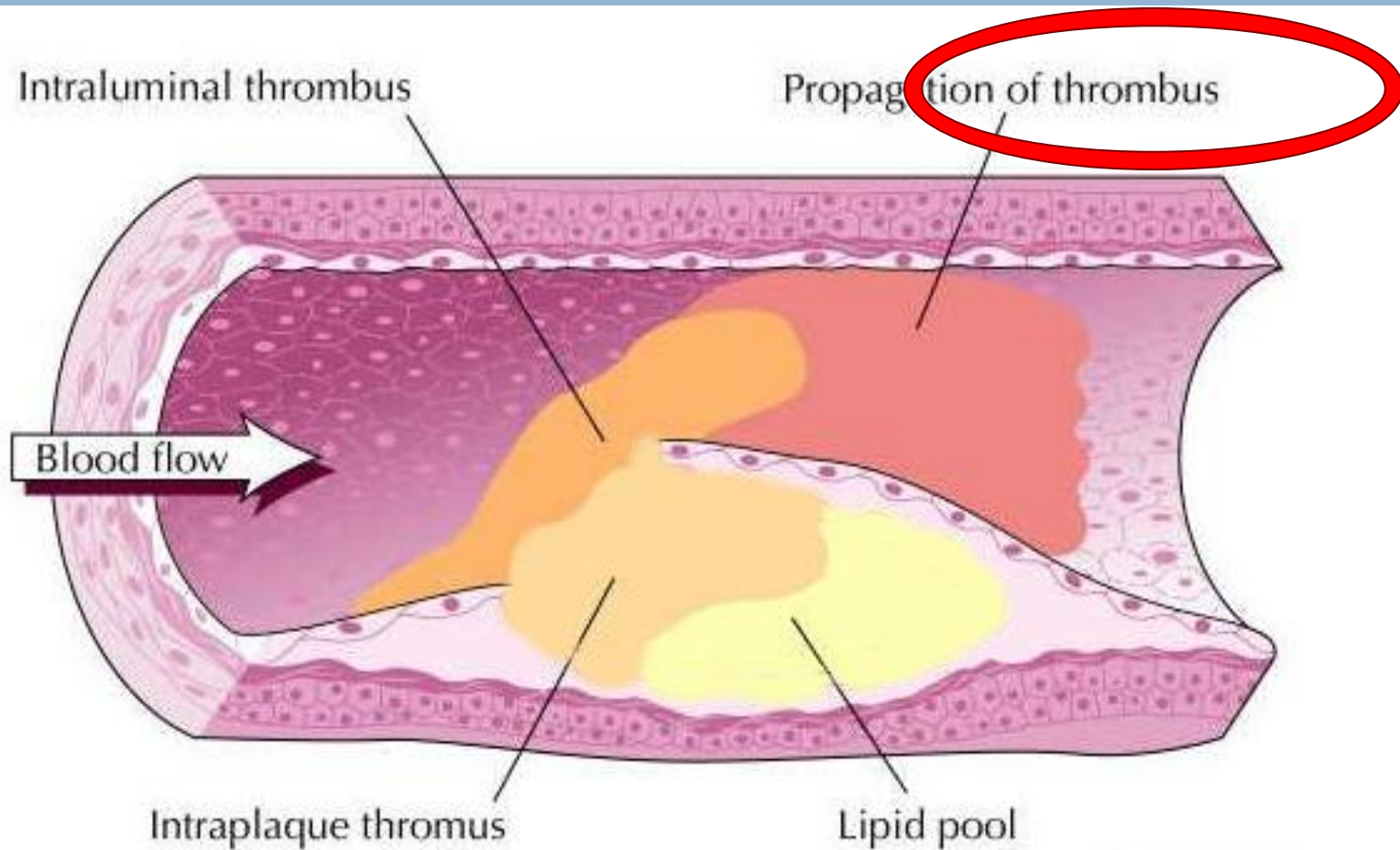


**STATINS**

# Stable vs. unstable atherosclerotic plaque

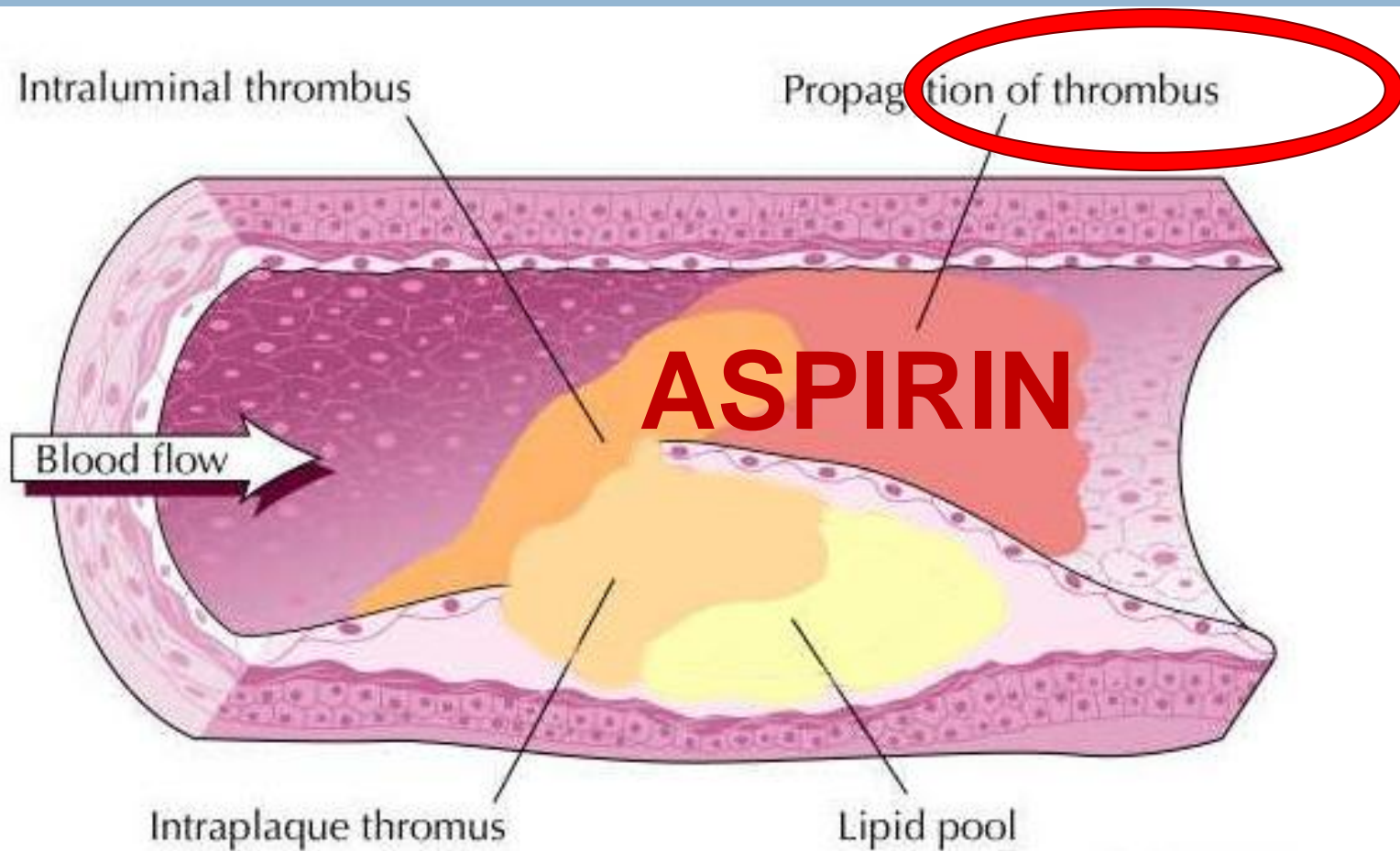


# Unstable atherosclerotic plaque → ACS

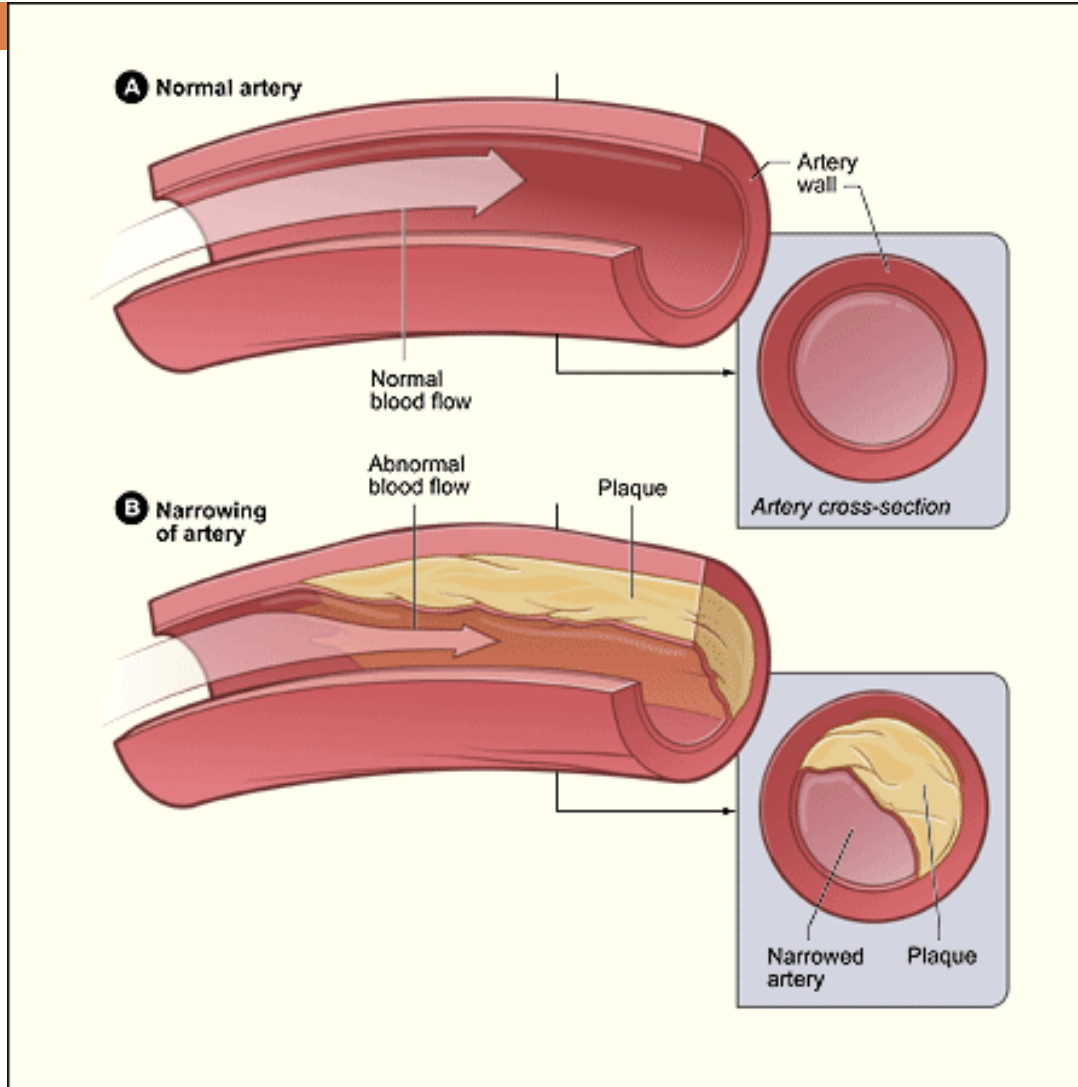




# Unstable atherosclerotic plaque → ACS

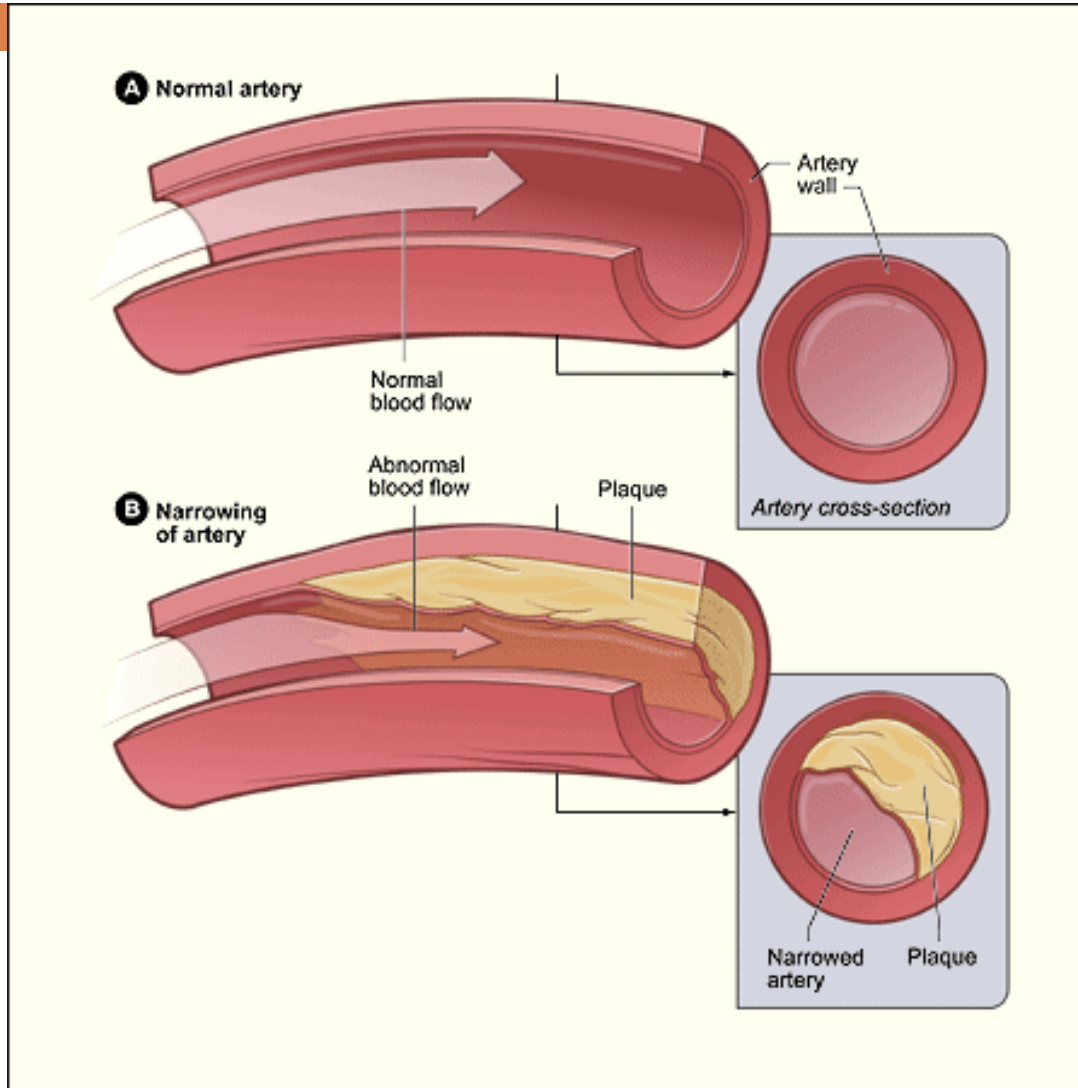


# Stable atherosclerotic plaque → stable CAD





# Stable atherosclerotic plaque → stable CAD



**At rest:**

$O_2$  supply =  $O_2$  demand

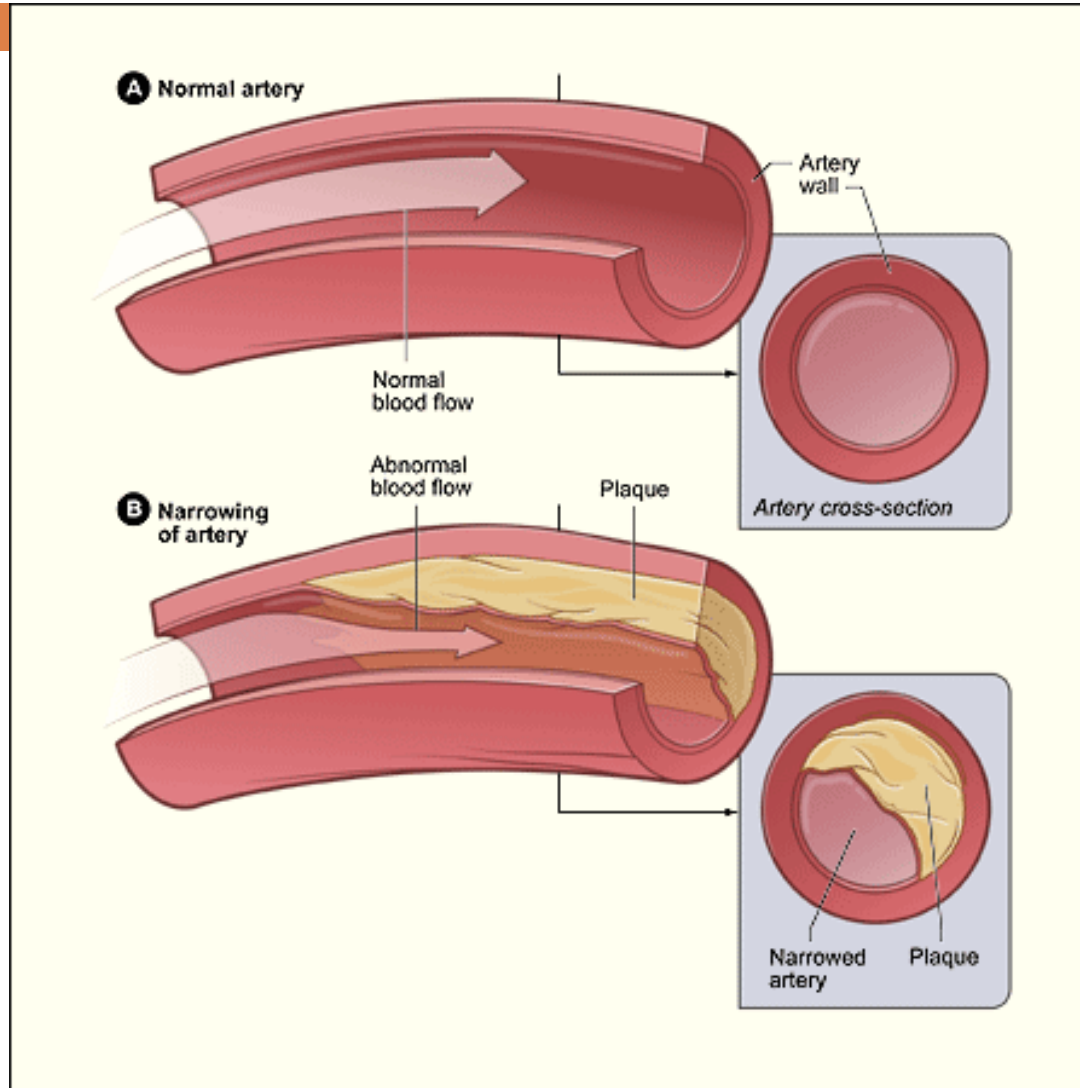
**On exertion:**

↑  $O_2$  demand

↑  $O_2$  supply

$O_2$  supply =  $O_2$  demand

# Stable atherosclerotic plaque → stable CAD



**At rest:**

$O_2$  supply =  $O_2$  demand

**On exertion:**

↑  $O_2$  demand

--  $O_2$  supply

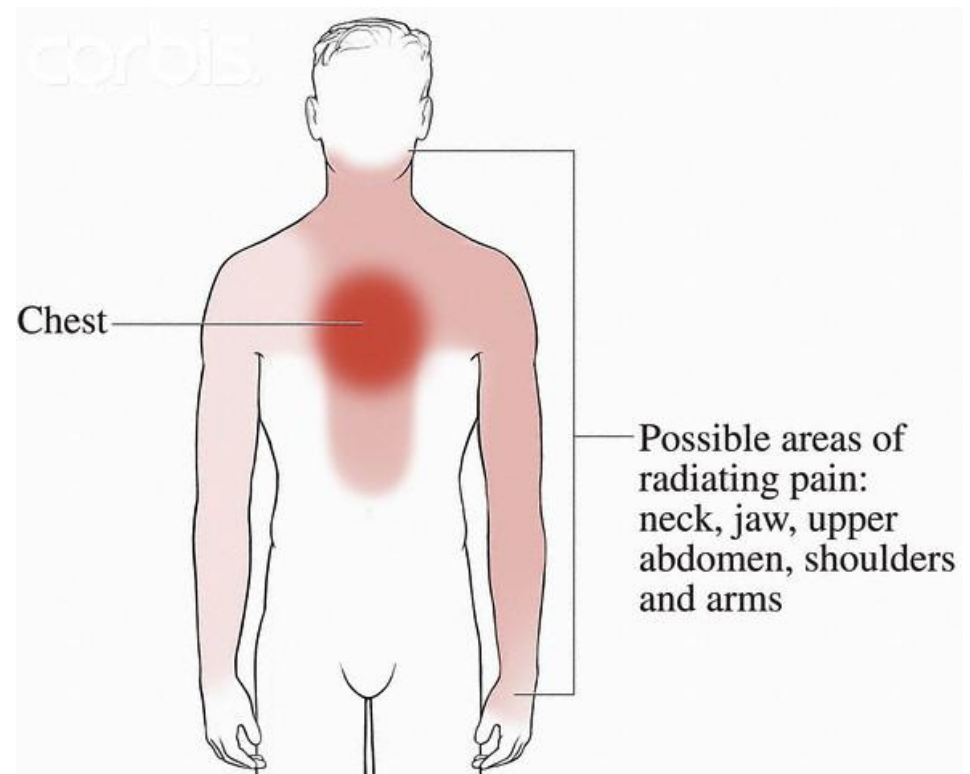
$O_2$  supply <  $O_2$  demand

# Typical anginal pain



# Typical anginal pain

- 1) Pain onset (factors that provoke pain)
- 2) Pain character
- 3) Pain termination



# Anginal equivalent

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- Dyspnea
- Fatigue
- Dizziness & syncope
- Nausea

# Diagnosis?

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- Interview
- Physical examination
- Blood tests
- ECG
- .....?

# Diagnosis?

## □ Interview

- ~~Physical examination~~
- ~~Blood tests~~
- ECG (during pain)
- **Stress test: ECG, ECHO, SPECT, CMR, PET**
- **CT angiography**
- **Invasive coronary angiography**

# Diagnosis?

## □ Interview

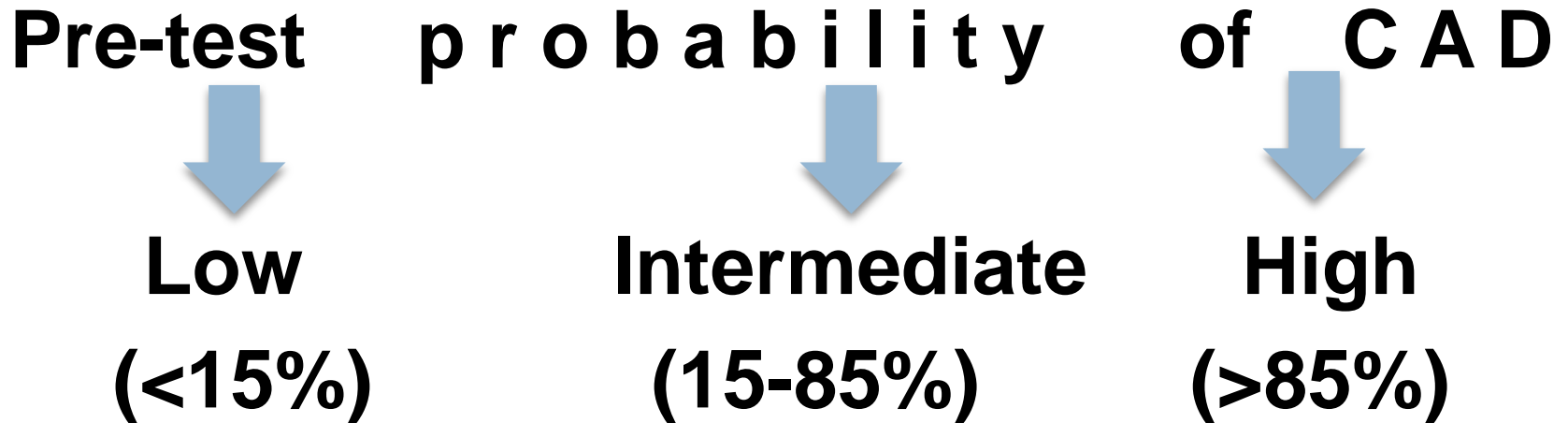
**Pre-test probability of CAD**

- 1) Risk factors (age, gender)**
- 2) Pain characteristic**



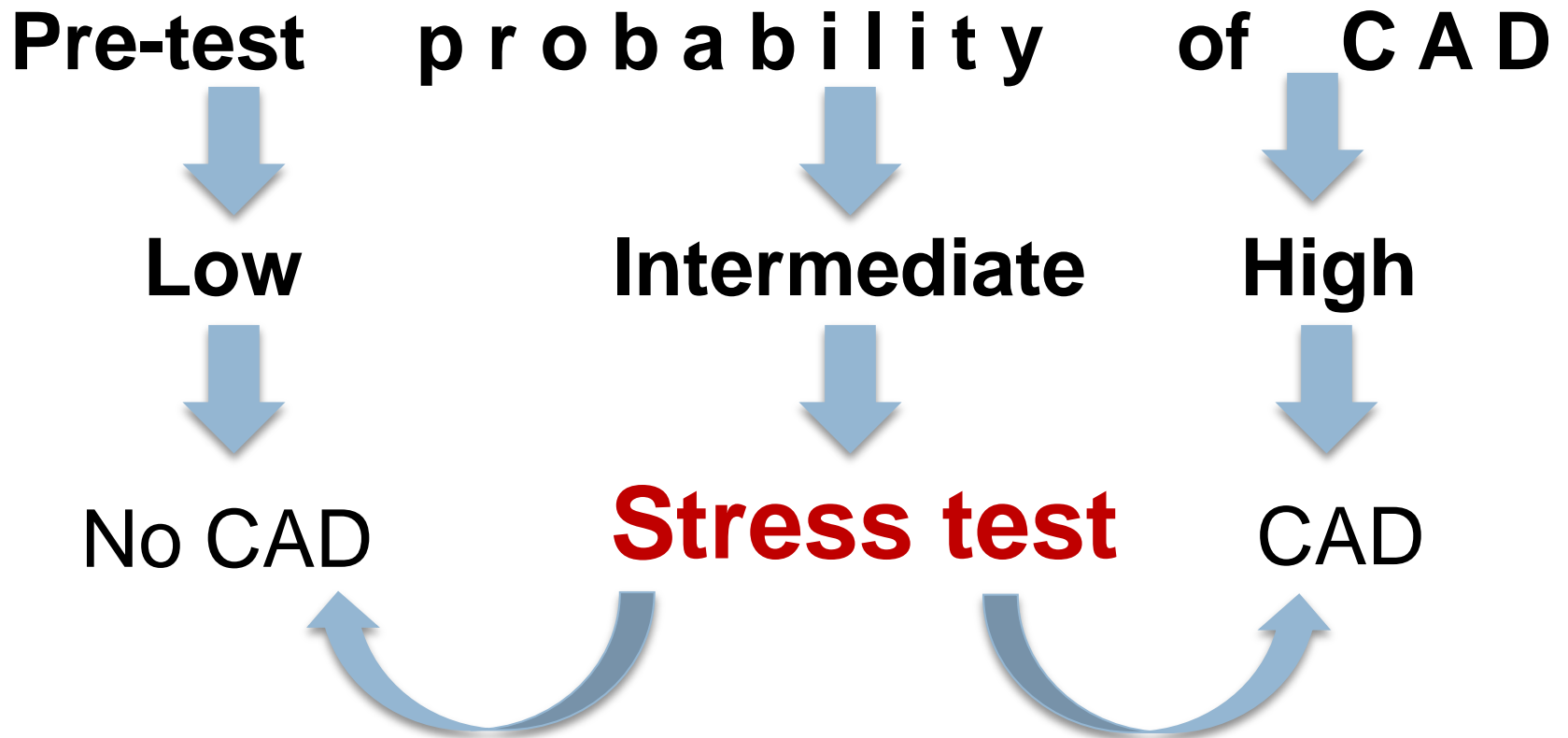
# Diagnosis?

## □ Interview



# Diagnosis?

## □ Interview



**Table 13** Clinical pre-test probabilities<sup>a</sup> in patients with stable chest pain symptoms<sup>108</sup>

Age	Typical angina		Atypical angina		Non-anginal pain	
	Men	Women	Men	Women	Men	Women
30–39	59	28	29	10	18	5
40–49	69	37	38	14	25	8
50–59	77	47	49	20	34	12
60–69	84	58	59	28	44	17
70–79	89	68	69	37	54	24
>80	93	76	78	47	65	32

# Diagnosis?

## □ Interview

Pre-test probability of CAD

Low

Intermediate

High

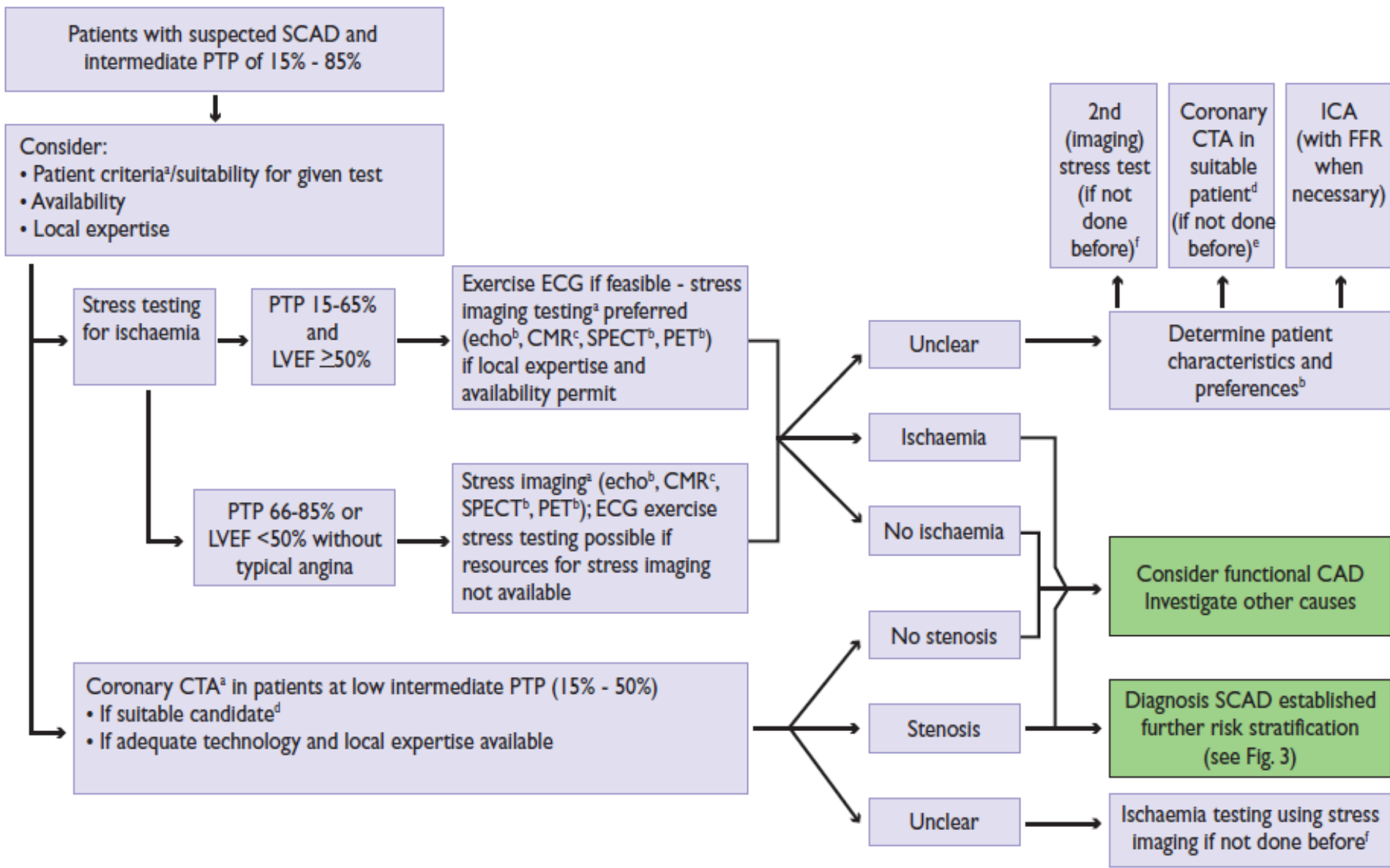
No CAD

**Stress test**

CAD



# Intermediate pre-test probability of CAD



# Diagnosis?

## □ Interview

□ ~~Physical examination~~

□ ~~Blood tests~~

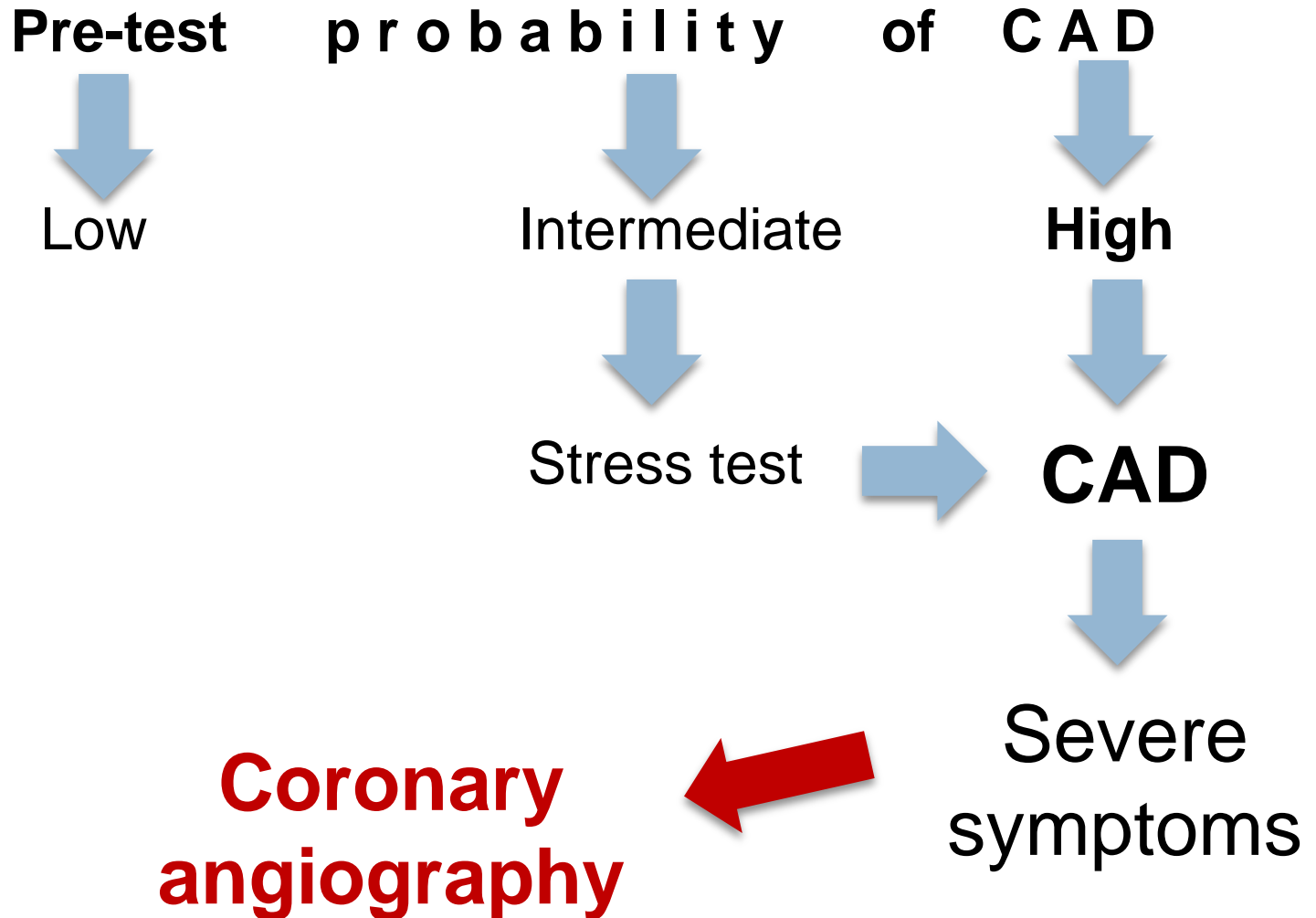
□ ECG (during pain)

□ **Stress test: ECG, ECHO, SPECT, CMR, PET**

□ **CT angiography**

□ **Invasive coronary angiography ?**

# Diagnosis?



Stable CAD



Severe symptoms (CCS III/IV) despite OMT

*or*

high risk of CV death



Coronary angiography



**Revascularization?**



# Indications for revascularization in stable CAD

Indication <sup>a</sup>	To improve prognosis:		To improve symptoms persistent on OMT:	
	Class <sup>d</sup>	Level <sup>e</sup>	Class <sup>d</sup>	Level <sup>e</sup>
A Heart Team approach to revascularization is recommended in patients with unprotected left main, 2–3 vessel disease, diabetes or comorbidities.	I	C	I	C
Left main >50% diameter stenosis <sup>b</sup> .	I	A	I	A
Any proximal LAD >50% diameter stenosis <sup>b</sup> .	I	A	I	A
2–3 vessel disease with impaired LV function / CHF.	I	B	IIa	B
Single remaining vessel (>50% diameter stenosis <sup>b</sup> ).	I	C	I	A
Proven large area of ischaemia (>10% LV <sup>c</sup> )	I	B	I	B
Any significant stenosis with limiting symptoms or symptoms non responsive/intolerant to OMT.	NA	NA	I	A
Dyspnoea/cardiac heart failure with >10% ischaemia/viability <sup>c</sup> supplied by stenosis >50%.	IIb	B <sup>429, 430</sup>	IIa	B
No limiting symptoms with OMT in vessel other than left main or proximal LAD or single remaining vessel or vessel subtending area of ischaemia <10% of myocardium or with FFR ≥0.80.	III	A	III	C



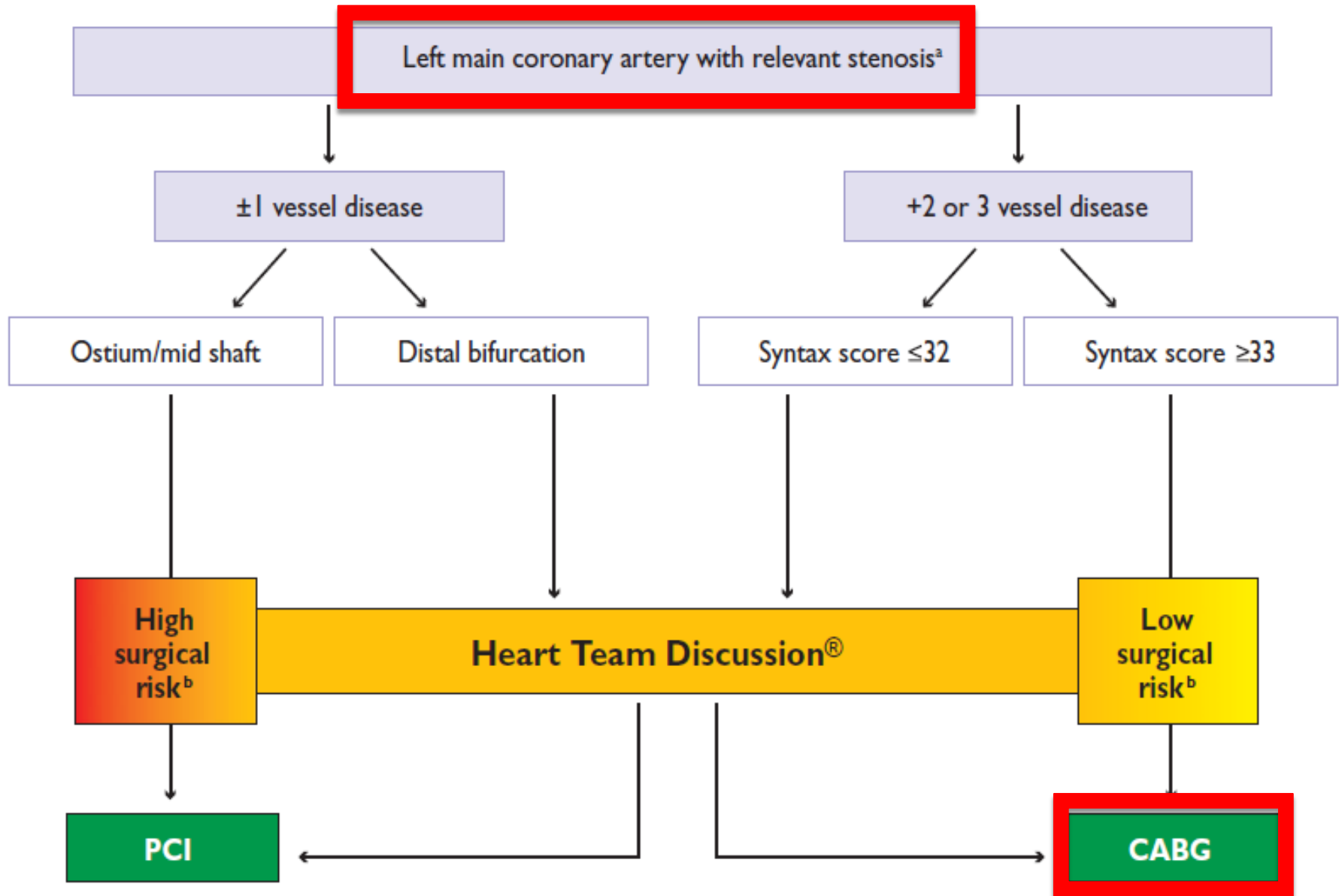
In **ACS** → revascularization (usually a.s.a.p.)

In **stable CAD** → revascularization only  
in specific situations

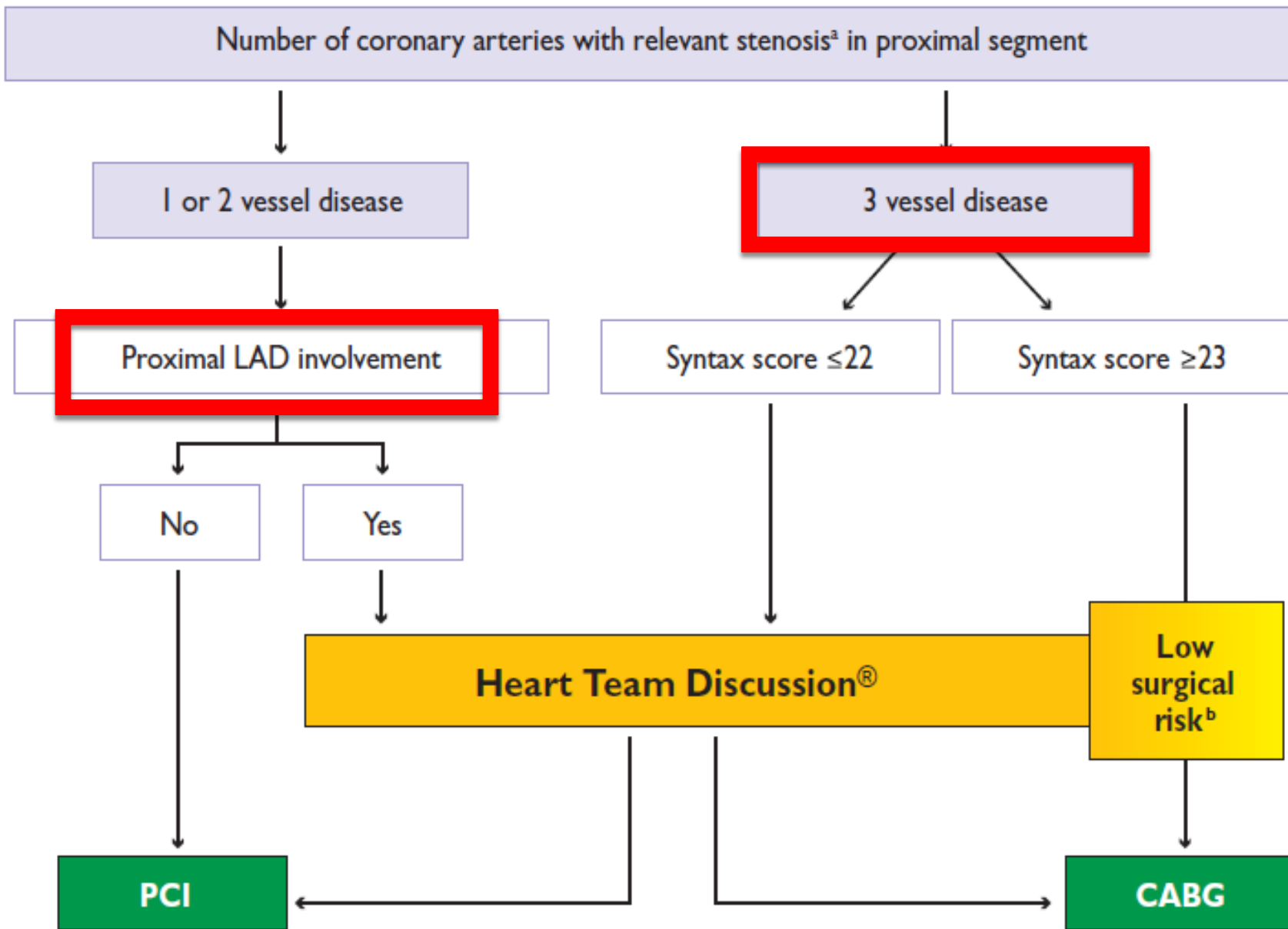
# Revascularization in stable CAD: **PCI** or **CABG**?



# Revascularization in stable CAD: **PCI** or **CABG**?



# Revascularization in stable CAD: **PCI** or **CABG**?



# Canadian Cardiovascular Society

CCS class	Class characteristic
I	No limitation of ordinary activity. Angina occurs with sudden, intensive or prolonged exertion at work or recreation
II	Slight limitation of ordinary activity. Angina occurs: <ul style="list-style-type: none"><li>- on walking or climbing stairs rapidly</li><li>- on walking &gt; 200 m at a normal pace</li><li>- on climbing &gt; 1 flight of stairs at a normal pace</li><li>- walking in cold, in wind, after heavy meals</li><li>- within a few hours after awakening</li><li>- under emotional stress</li></ul>
III	Marked limitation of ordinary physical activity. Angina occurs: <ul style="list-style-type: none"><li>- on walking &lt; 200 m at a normal pace</li><li>- on climbing 1 flight of stair at a normal pace</li></ul>
IV	Any physical activity causes angina. Angina can occur at rest

# Canadian Cardiovascular Society

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IV	Any physical activity causes angina. Angina can occur at rest

# Classifications in cardiology

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Ischemic heart disease



**CCS**  
**classificaton**

Heart failure



**NYHA**  
**classificaton**



# Risk factors for atherosclerosis



# Risk factors for atherosclerosis

Non-modifiable	Modifiable
Age	Smoking
Male gender	Hypertension
Family history	Diabetes mellitus
Ethnic origin	High TC & LDL levels
	Obesity & the metabolic syndrome (High TG, low HDL)
	High calorie high fat diet
	Physical inactivity

# Risk factors for atherosclerosis

Age	Smoking
Male gender	Hypertension
Family history	Diabetes mellitus
Ethnic origin	High TC & LDL levels
Inflammation	Obesity & the metabolic syndrome (High TG, low HDL)
Oxidative stress	High calorie high fat diet
Fibrinogen, homocysteine	Physical inactivity

# Hypertension?



# Hypertension?

---

**$\geq 140 / 90$  mmHg**

# Diabetes mellitus?



# Classification of hyperglycaemic states

State	Fasting glycaemia (mg/dl)	Postprandial glycaemia (mg/dl)
Normal		
Impaired fasting glucose (IFG)		
Impaired glucose tolerance (IGT)		
Diabetes mellitus		

# Classification of hyperglycaemic states

State	Fasting glycaemia (mg/dl)	Postprandial glycaemia (mg/dl)
Normal	< 100	< 140
Impaired fasting glucose (IFG)	100-125	
Impaired glucose tolerance (IGT)		140-199
Diabetes mellitus	≥ 126	≥ 200



# The metabolic syndrome

Waist circumference			
	men	$\geq 94$ cm	( $\geq 102$ cm)
	women	$\geq 80$ cm	( $\geq 88$ cm)
Triglyceride (or treatment)		$\geq 150$ mg/dl	
HDL (or treatment)			
	men	$< 40$ mg/dl	
	women	$< 50$ mg/dl	
BP (or hypotensive treatment)		$\geq 130/85$ mmHg	
Glycaemia (or diagnosed DM t2)		$\geq 100$ g/dl	

# Coronary artery disease prevention



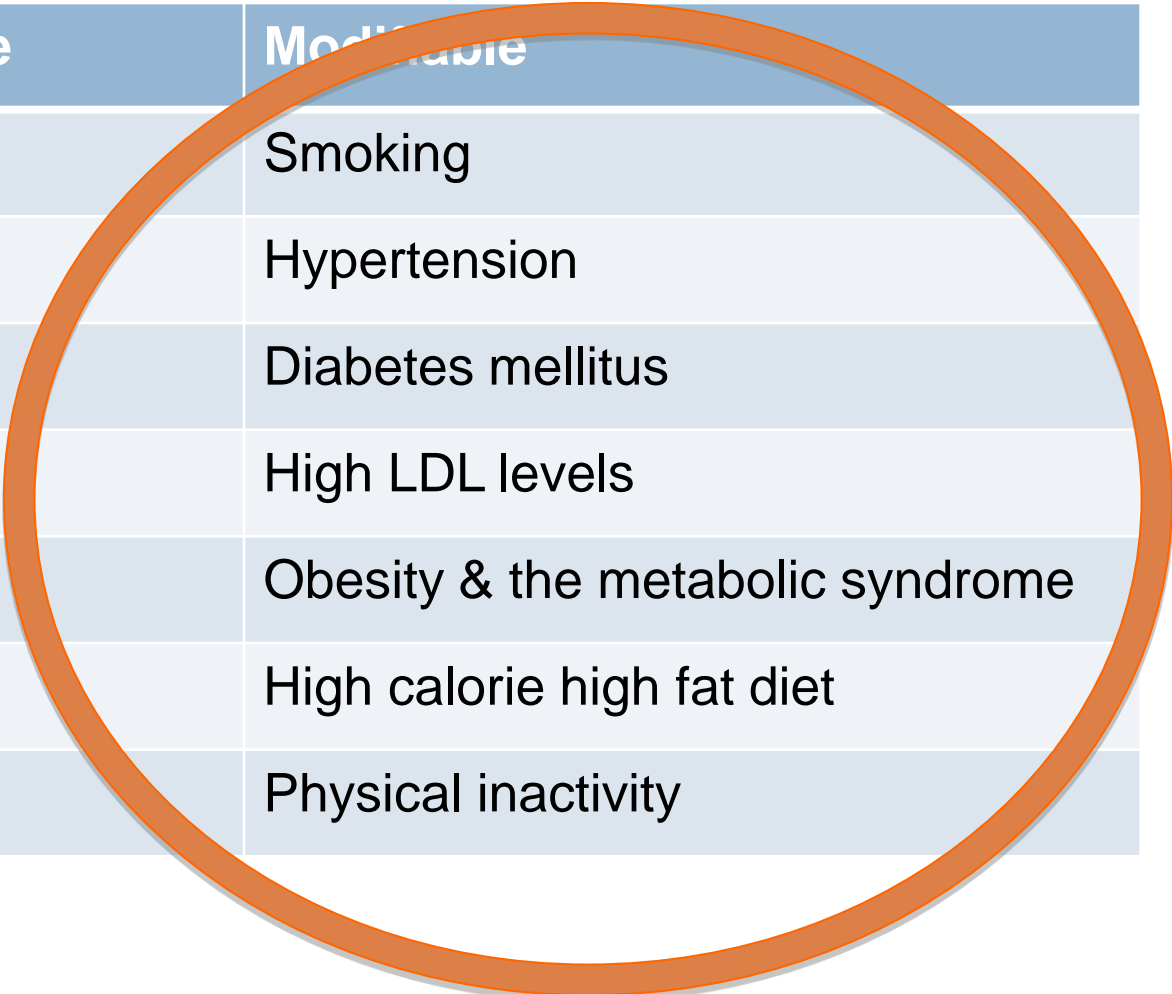
**primary**



**secondary**

# Prevention

Non-modifiable	Modifiable
Age	Smoking
Male gender	Hypertension
Family history	Diabetes mellitus
	High LDL levels
	Obesity & the metabolic syndrome
	High calorie high fat diet
	Physical inactivity



# Prevention

Non-modifiable	Modifiable
Age	Smoking
Male gender	Hypertension
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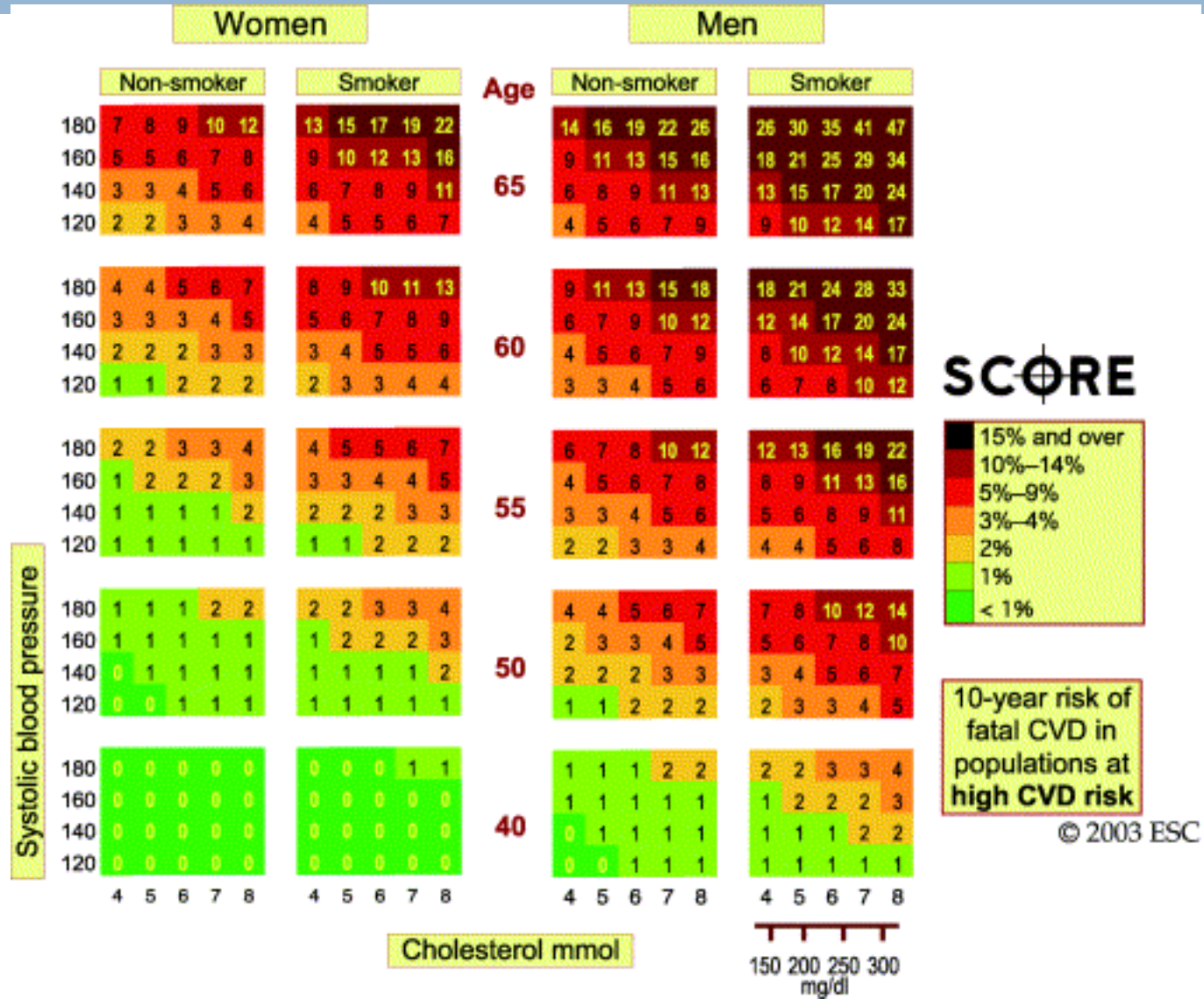
# Prevention

Non-modifiable	Modifiable
Age	Smoking
Male gender	Hypertension
Family history	Diabetes mellitus
	High LDL levels
	Obesity & the metabolic syndrome
	High calorie high fat diet
	Physical inactivity

# Therapeutic goals

CV risk	Low / moderate	High	Very high
	SCORE <5%	SCORE 5-10%	<ul style="list-style-type: none"><li>- established CVD</li><li>- DM2</li><li>- DM1 + complicat.</li><li>- GFR&lt;60 ml/min</li><li>- SCORE ≥10%</li></ul>
<b>LDL</b>	<115 mg/dl	<100 mg/dl	<70 mg/dl or ↓ ≥50%

# Low vs high global cardiovascular risk





# Secondary prevention

What?	In whom?	What for? Prognosis	What for? Symptoms
<b>Aspirin</b> (75-150 mg)	Every patient with CVD	+	
<b>Statin</b>	Every patient with CVD	+	
<b>ACE-inhibitor</b>	Esp. in pts with DMt2, hypertension In all pts: <b>post-MI</b> , with HF	+	
<b>Beta-blocker</b>	CCS II-IV In all pts: <b>post-MI</b> , with HF	+ post-MI, HF	+
<b>Calcium channel blockers</b> (diltiazem, verapamil)	CCS II-IV		+
<b>Long-acting nitrates</b>	CCS II-IV		+
<b>Short-acting nitrates</b>	immediate short term symptomes relief		+
<b>Ivabradine</b>	CCS II-IV		+

# Question 1

1. A 72-year old man, a smoker, complains of retrosternal chest pain and SOB after climbing 2 flights of stairs. The pain usually stops after 2-3 minutes of rest.

How would you diagnose CAD in this patient?

- a) I have just diagnosed it 😊
- b) perform a stress test
- c) perform coronary angiography
- d) run blood test for troponin concentration

# Question 1

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How would you diagnose CAD in this patient?

a) I have just diagnosed it 😊

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d) run blood test for troponin concentration

## Question 2

2. A 72-year old man complains of retrosternal chest pain and SOB after climbing 2 flights of stairs. The pain usually stops after 2-3 minutes of rest.

What CCS class is he?

- a) CCS class I
- b) CCS class II
- c) CCS class III
- d) CCS class IV

## Question 2

2. A 72-year old man complains of retrosternal chest pain and SOB after climbing 2 flights of stairs. The pain usually stops after 2-3 minutes of rest.

What CCS class is he?

a) CCS class I

b) CCS class II

c) CCS class III

d) CCS class IV

# Question 3

3. Our patient is a smoker, normotensive and with LDL concentration of 100 mg/dl.

You recommend him to stop smoking.

What drugs would you prescribe him?

a) Aspirin, statin, long-acting nitrate

b) Aspirin, beta-blocker, short-acting nitrate

c) Aspirin, statin, beta-blocker, short-acting nitrate

d) Aspirin, ACE-inhibitor, long-acting nitrate

# Question 3

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c) Aspirin, statin, beta-blocker, short-acting nitrate

d) Aspirin, ACE-inhibitor, long-acting nitrate

# Question 4

4. Our patient is a smoker, normotensive and with LDL concentration of 100 mg/dl.

What LDL level would you like him to achieve?

a) it depends on his global cardiovascular risk,  
I would have to check in the EuroScore Risk Chart

b) LDL < 115 mg/dl

c) LDL < 100 mg/dl

d) LDL < 70 mg/dl



# Question 4

4. Our patient is a smoker, normotensive and with LDL concentration of 100 mg/dl.

What LDL level would you like him to achieve?

a) it depends on his global cardiovascular risk,  
I would have to check in the EuroScore Risk Chart

b) LDL < 115 mg/dl

c) LDL < 100 mg/dl

d) LDL < 70 mg/dl

# Question 5

5. Our patient comes back to you 3 months after his first visit. Since last week he has angina symptoms after climbing  $\frac{1}{2}$  flight of stairs. What CCS class is he?

- a) CCS class I
- b) CCS class II
- c) CCS class III
- d) CCS class IV

# Question 5

5. Our patient comes back to you 3 months after his first visit. Since last week he has angina symptoms after climbing  $\frac{1}{2}$  flight of stairs. What CCS class is he?

a) CCS class I

b) CCS class II

c) CCS class III

d) CCS class IV

# Question 6

6. What would you do in this patient?

- a) increase the dose of a beta-blocker
- b) increase the dose of aspirin and statin
- c) perform a stress test
- d) perform coronary angiography

# Question 6

6. What would you do in this patient?

- a) increase the dose of a beta-blocker
- b) increase the dose of aspirin and statin
- c) perform a stress test
- d) perform coronary angiography



Thank you for your attention 😊