Ischemic Heart Disease

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Ischemic Heart Disease

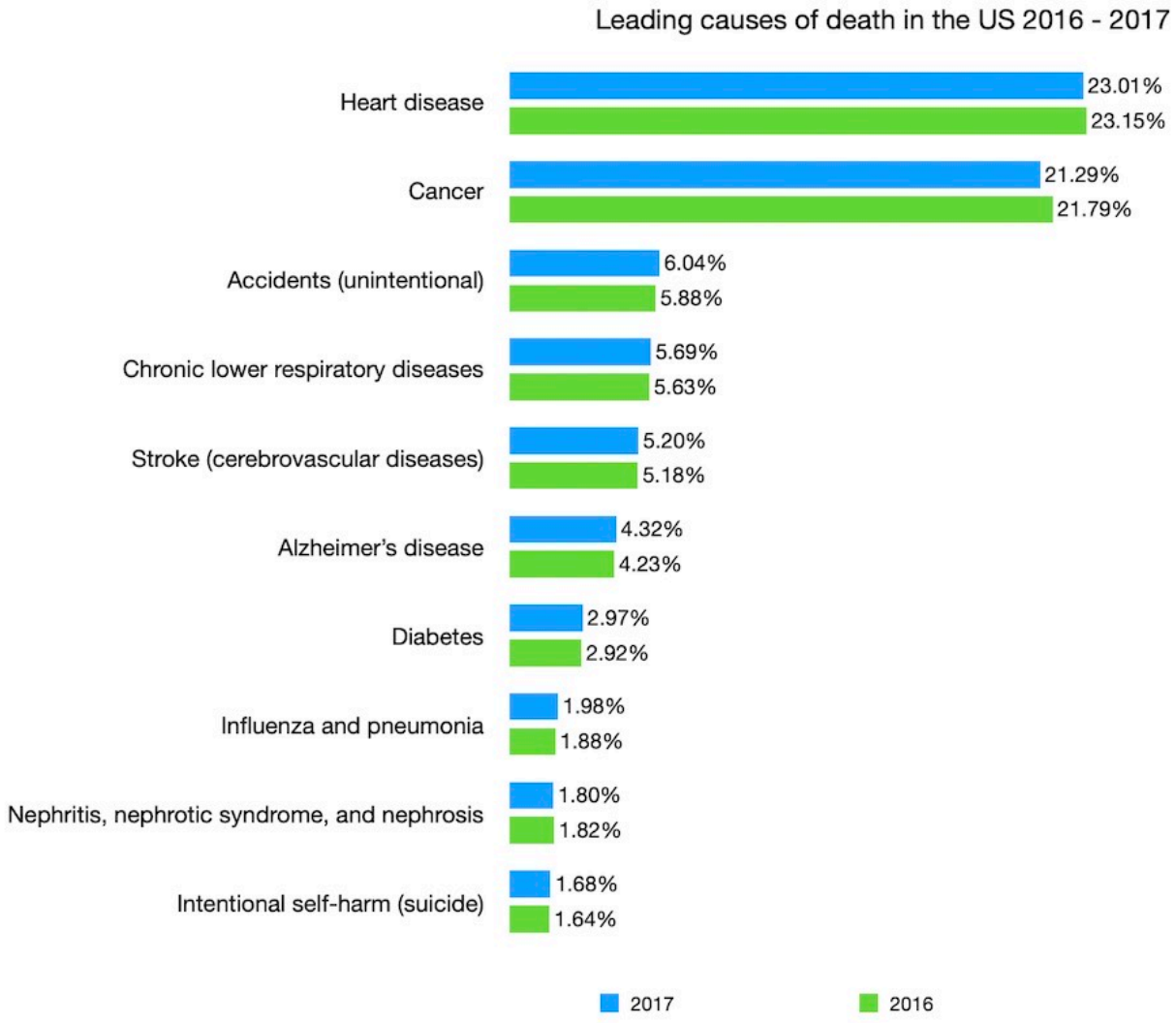
Definition

Ischemic heart disease is a condition determined by an imbalance between myocardial blood supply/demand at the cardiomyocite cellular level. Atherosclerosis of epicardial coronary arteries (coronary artery disease) is the dominant cause of the reduction of coronary blood flow. However, coronary blood flow may be impaired in patients with normal coronary arteries, too.

Coronary artery disease is a pathological process characterized by atherosclerotic plaque accumulation in the epicardial arteries, whether obstructive or non-obstructive.

Ischemic Heart Disease

Epidemiology



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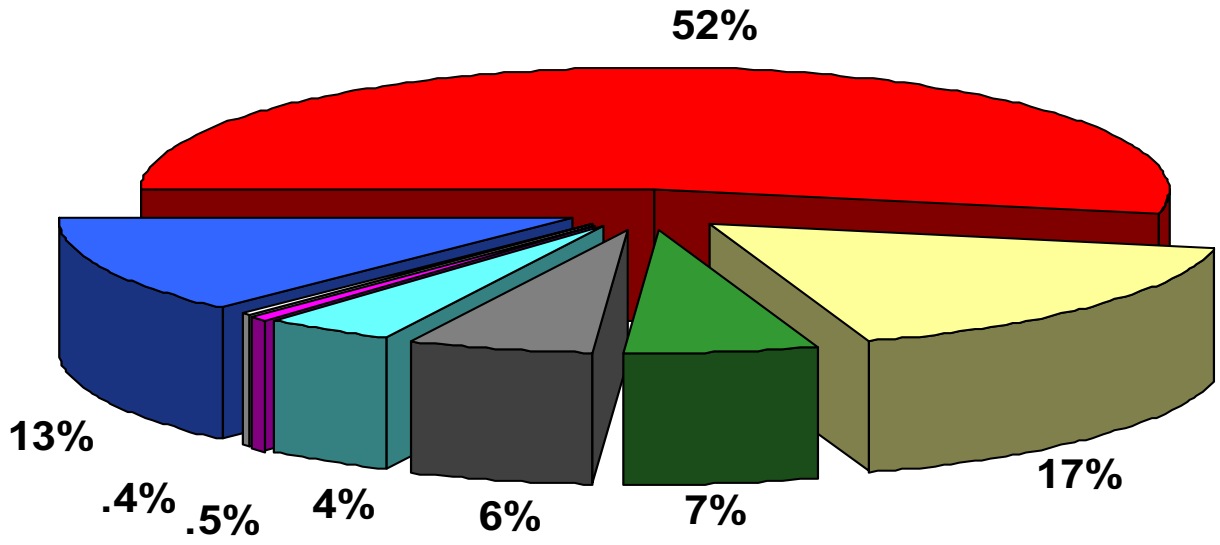
Causes of death from cardiovascular diseases



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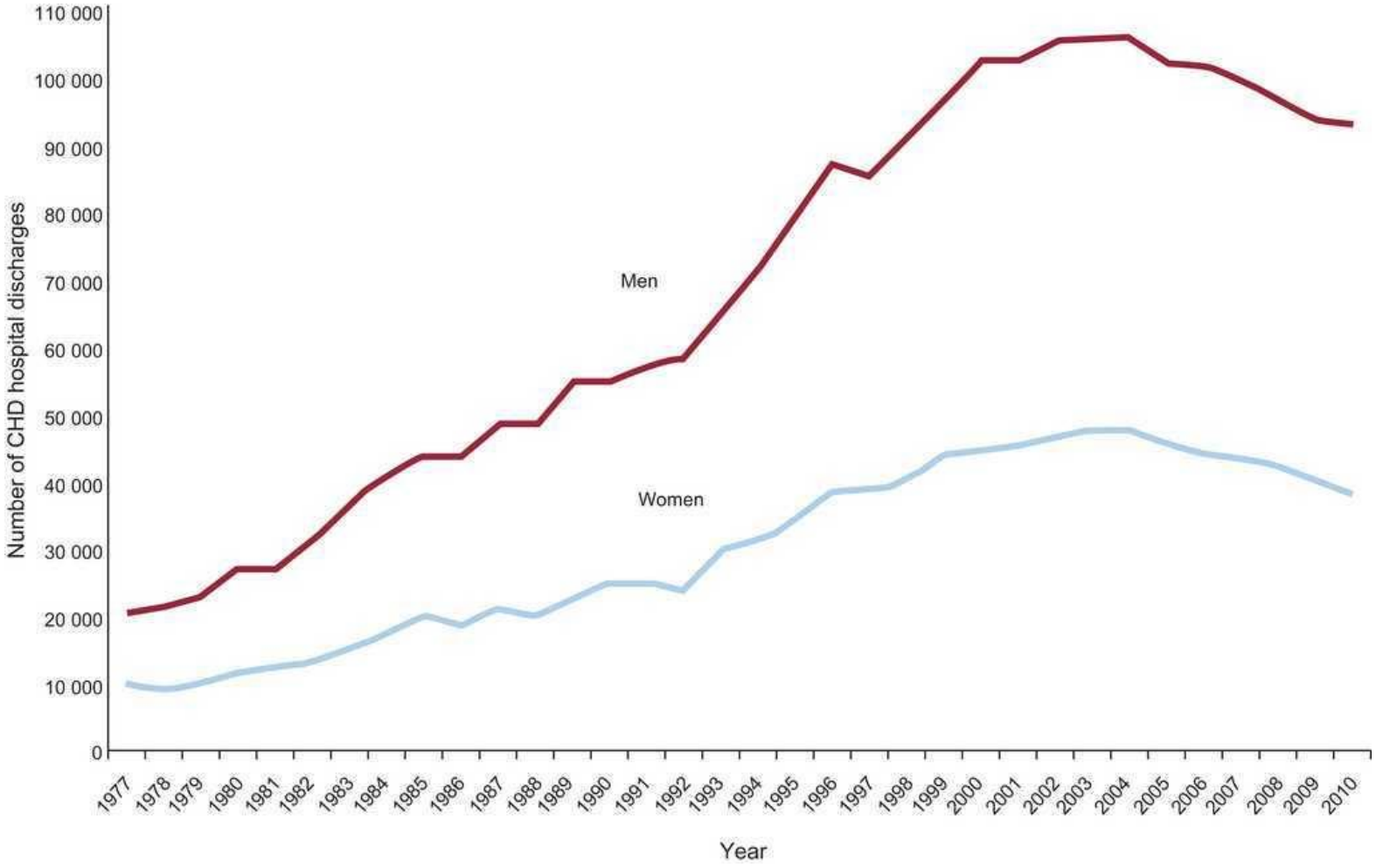
Epidemiology



Ferreira- Gonzales I. Rev Esp Cardiol 2014; 67: 139-44

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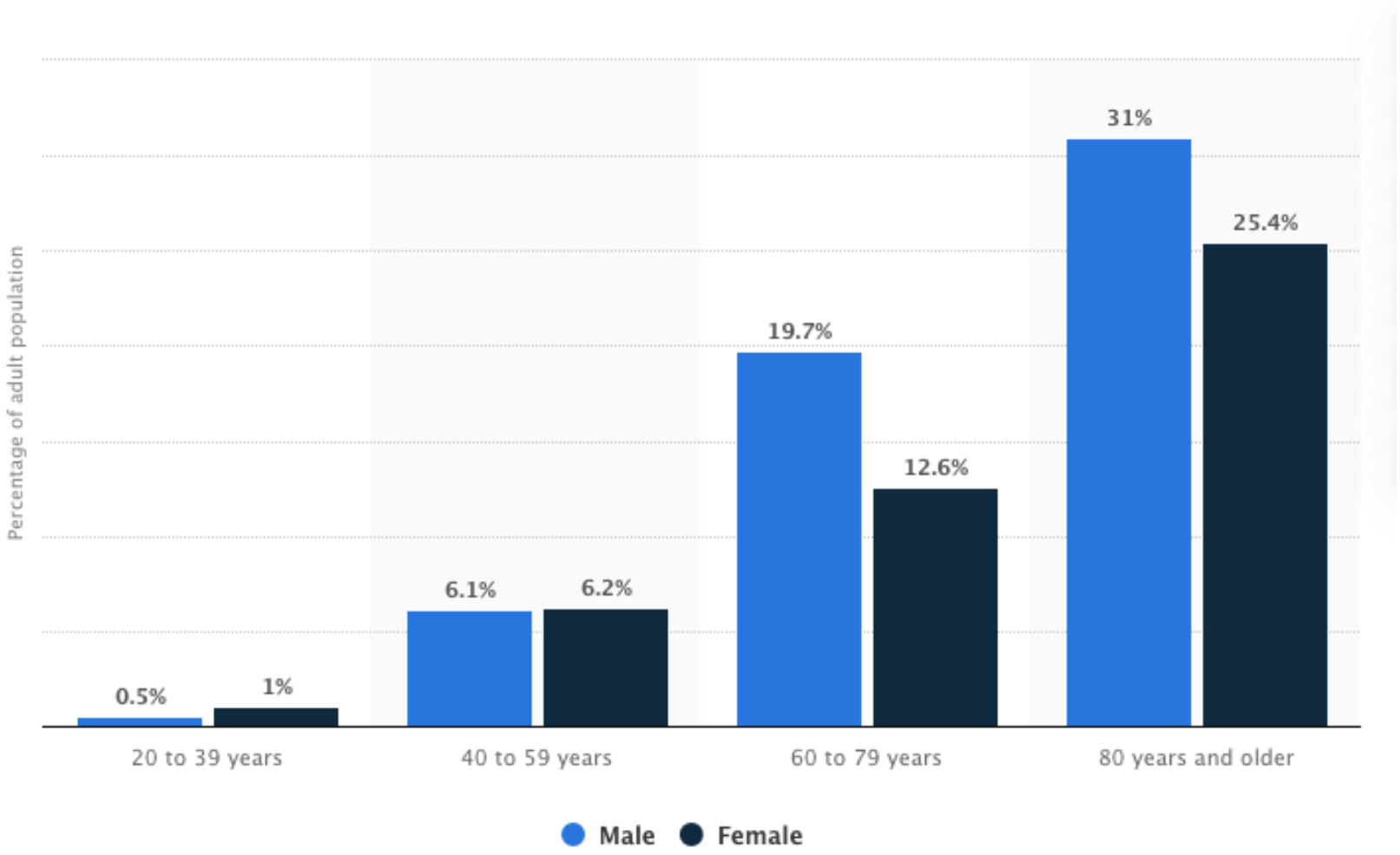
Epidemiology



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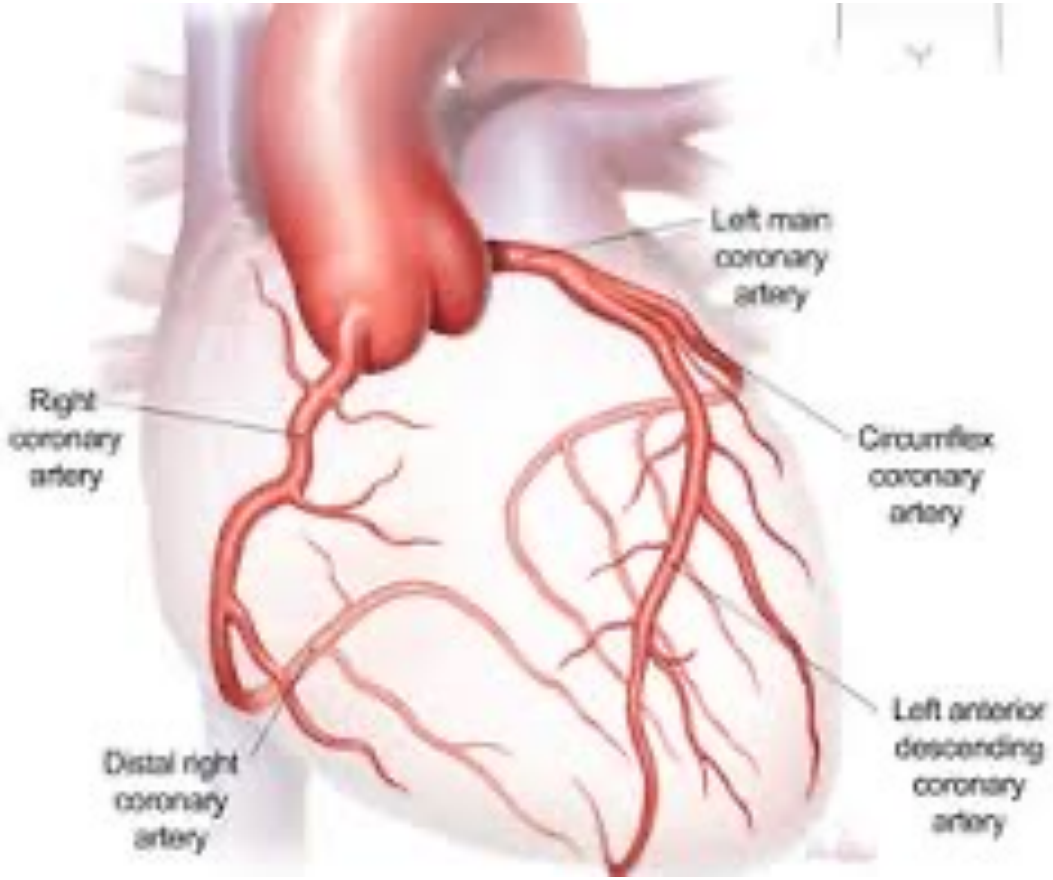
A disease of the coronary arteries



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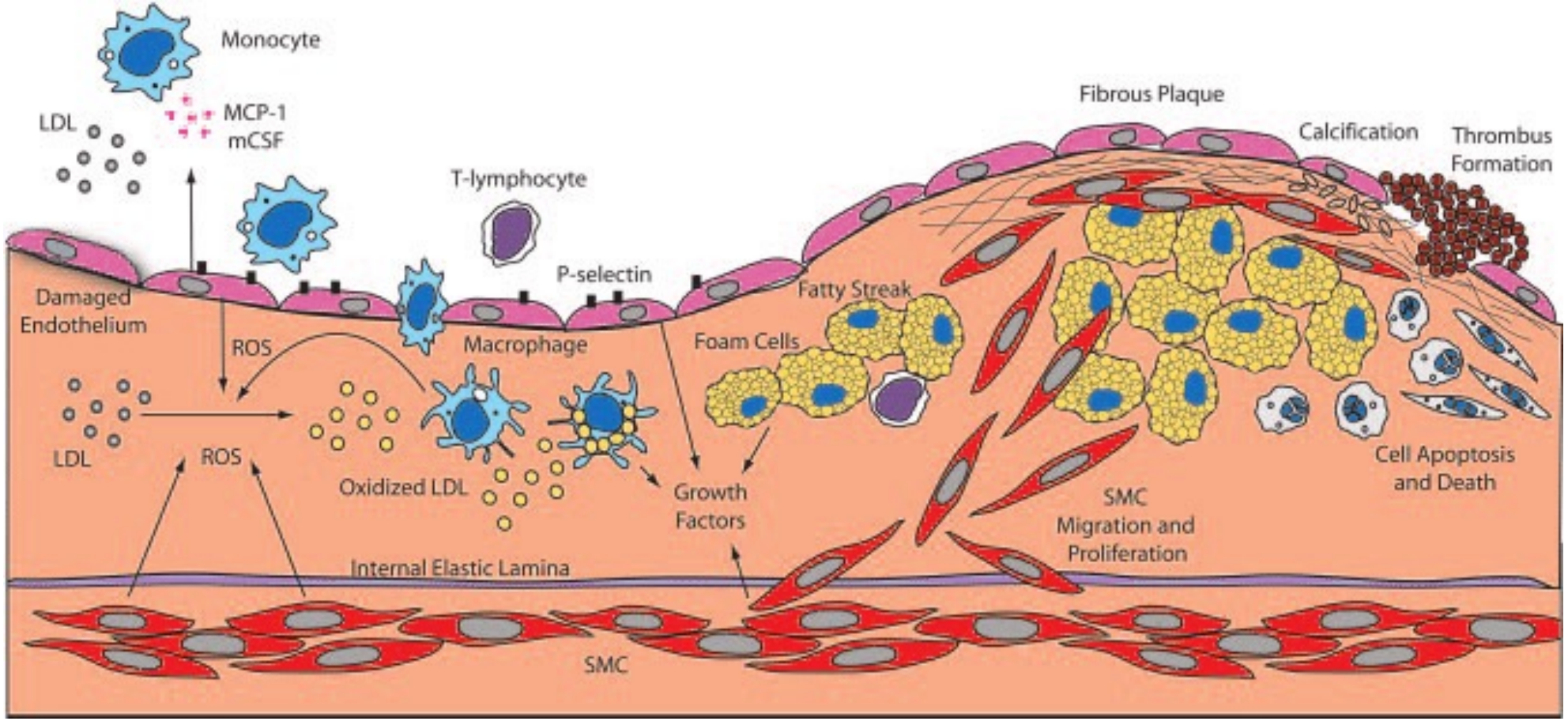
Pathogenesis of atherosclerosis



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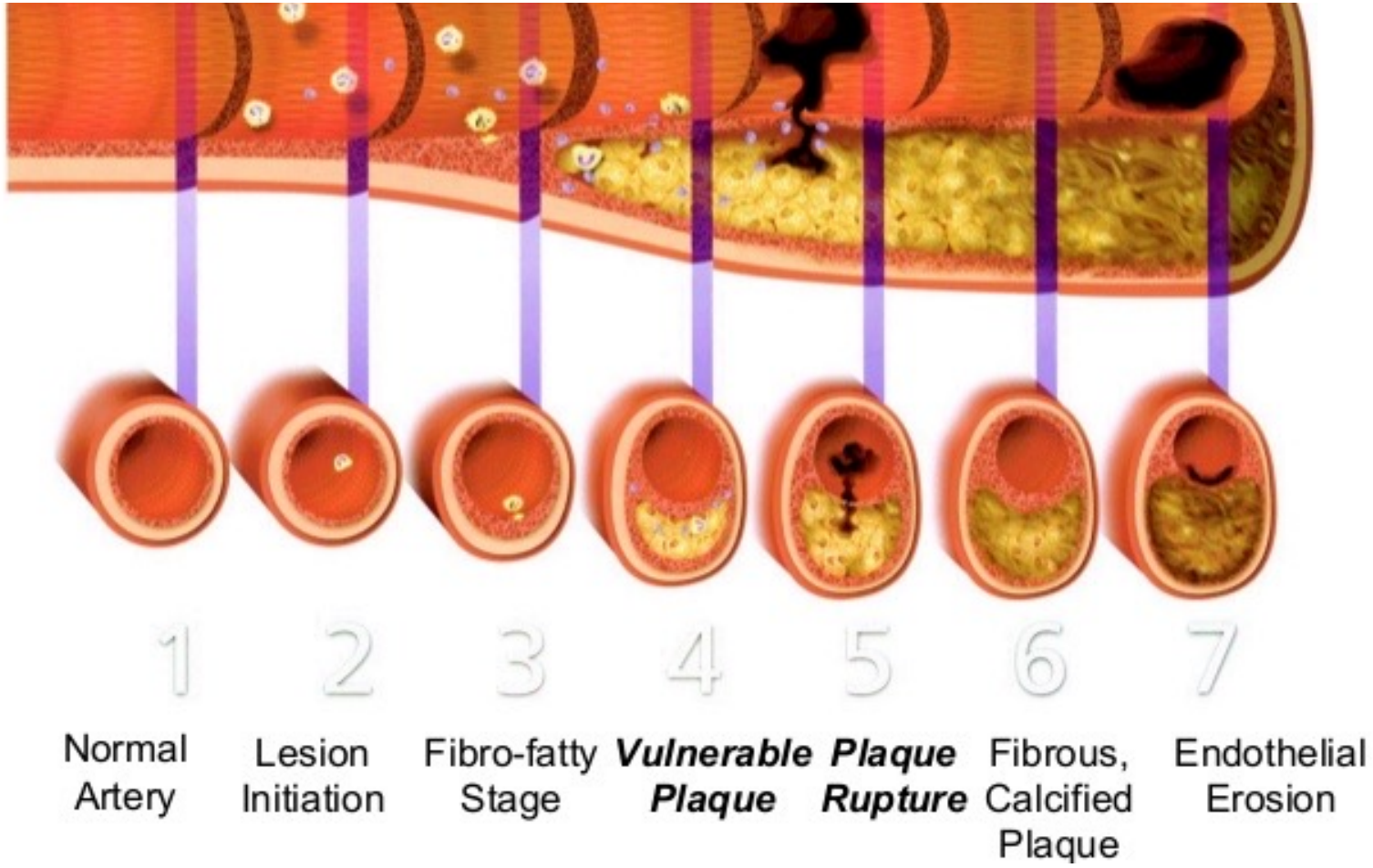
Evolution of coronary atherosclerosis



Libby. Circulation 2001; 104: 365

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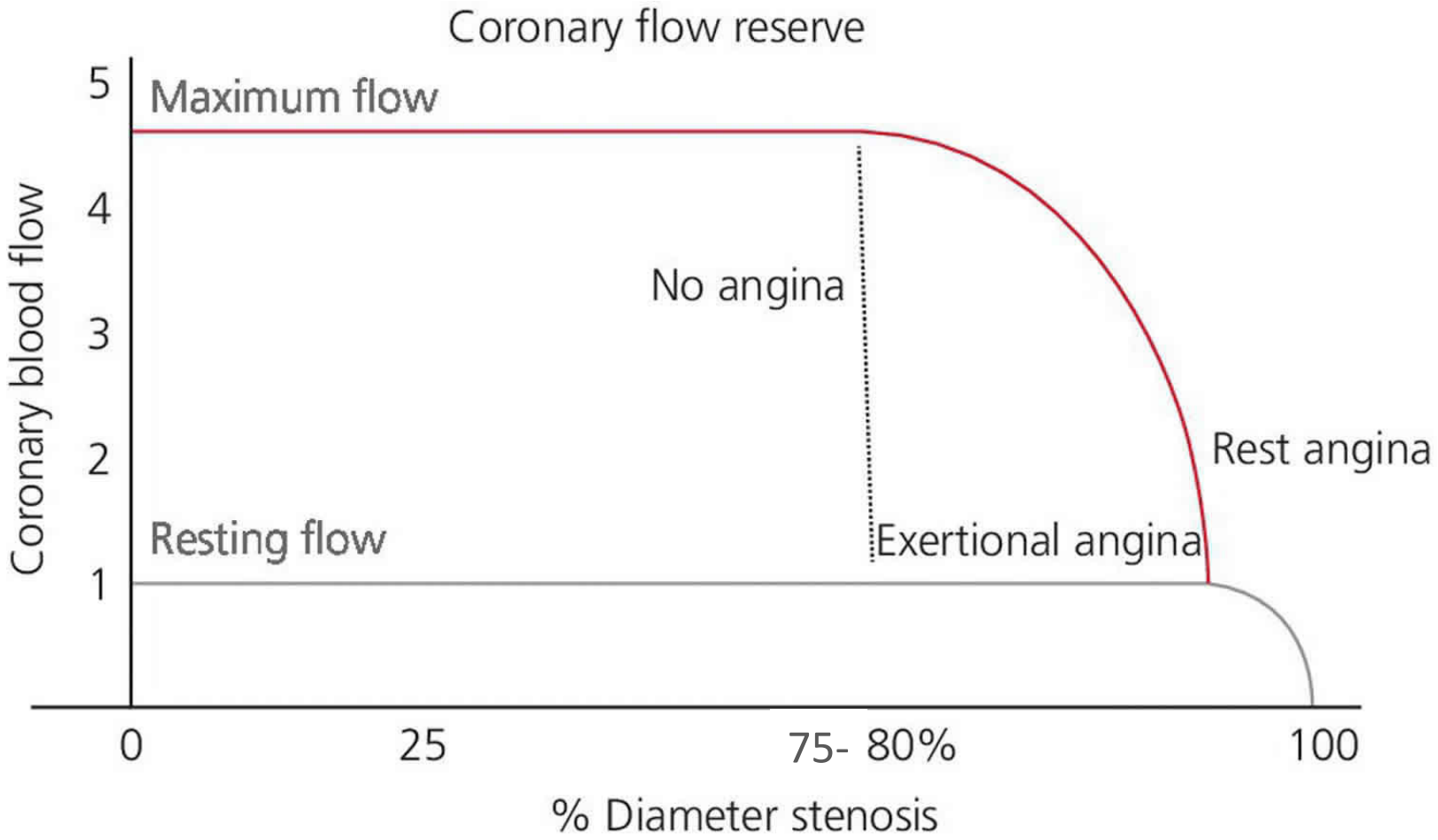
Pathophysiology of coronary artery disese



Gould KL, et al. Am J Cardiol 1974; 33: 87-94

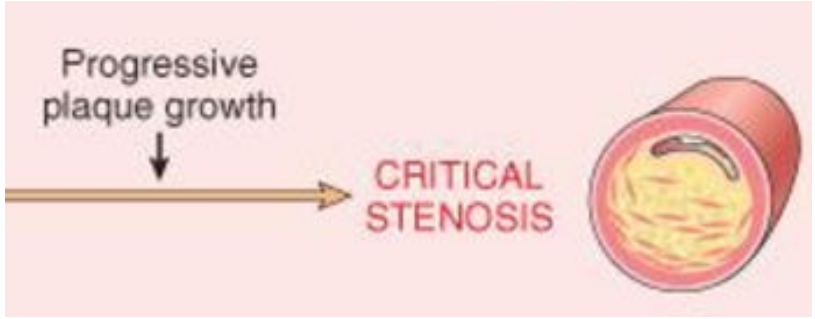
Ischemic Heart Disease

Clinical manifestations

Pathology

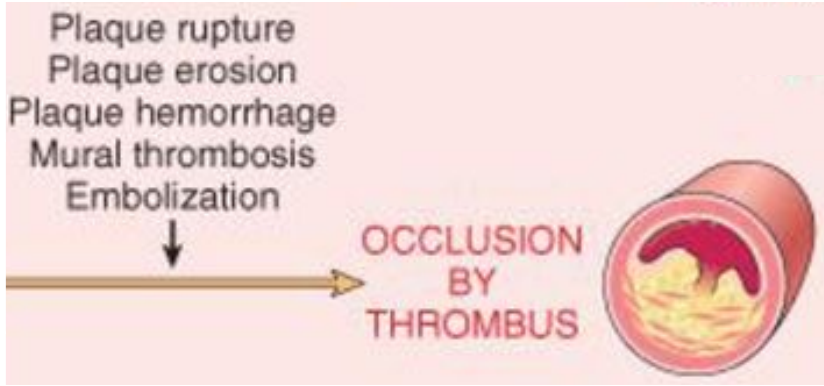
Chronic coronary syndromes

Stable angina	Ischemia due to fixed atheromatous stenosis of one or more coronary arteries
Heart failure	Myocardial dysfunction due to infarction or ischemia



Acute coronary syndromes

Unstable angina	Ischemia caused by dynamic obstruction of a coronary artery due to plaque rupture or erosion with superimposed thrombosis
Myocardial infarction	Myocardial necrosis caused by acute occlusion of a coronary artery due to plaque rupture or erosion with superimposed thrombosis
Arrhythmia	Cardiac rhythm alteration due to ischemia or infarction
Sudden death	Ventricular fibrillation, cardiac arrest or massive myocardial infarction



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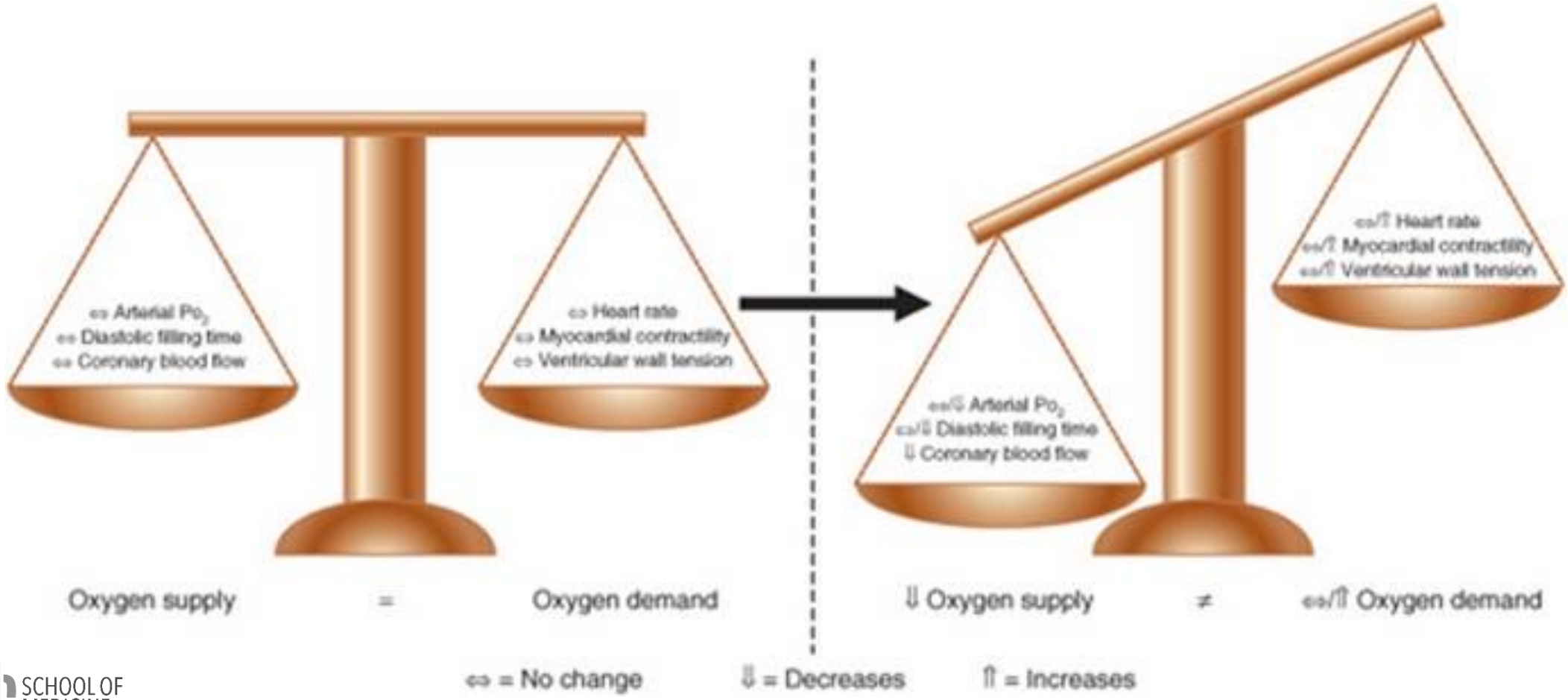
Pathogenesis of myocardial ischemia



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Conditions provoking or exacerbating myocardial ischemia

Increased oxygen demand

Noncardiac

Thyroid dysfunction

Sympathomometic toxicity (cocaine)

Hypertension

Anxiety

Arteriovenous fistole

Cardiac

Hypertrophic cardiomyopathy

Aortic stenosis

Dilated cardiomyopathy

Tachycardia

Decreased oxygen supply

Noncardiac

Anemia

Hypoxiemia, pneumonia, asthma, COPD, pulmonary hypertension, IPF, OSA

Sickle cell anemia

Hyperviscosity

Polycithemia

Cardiac

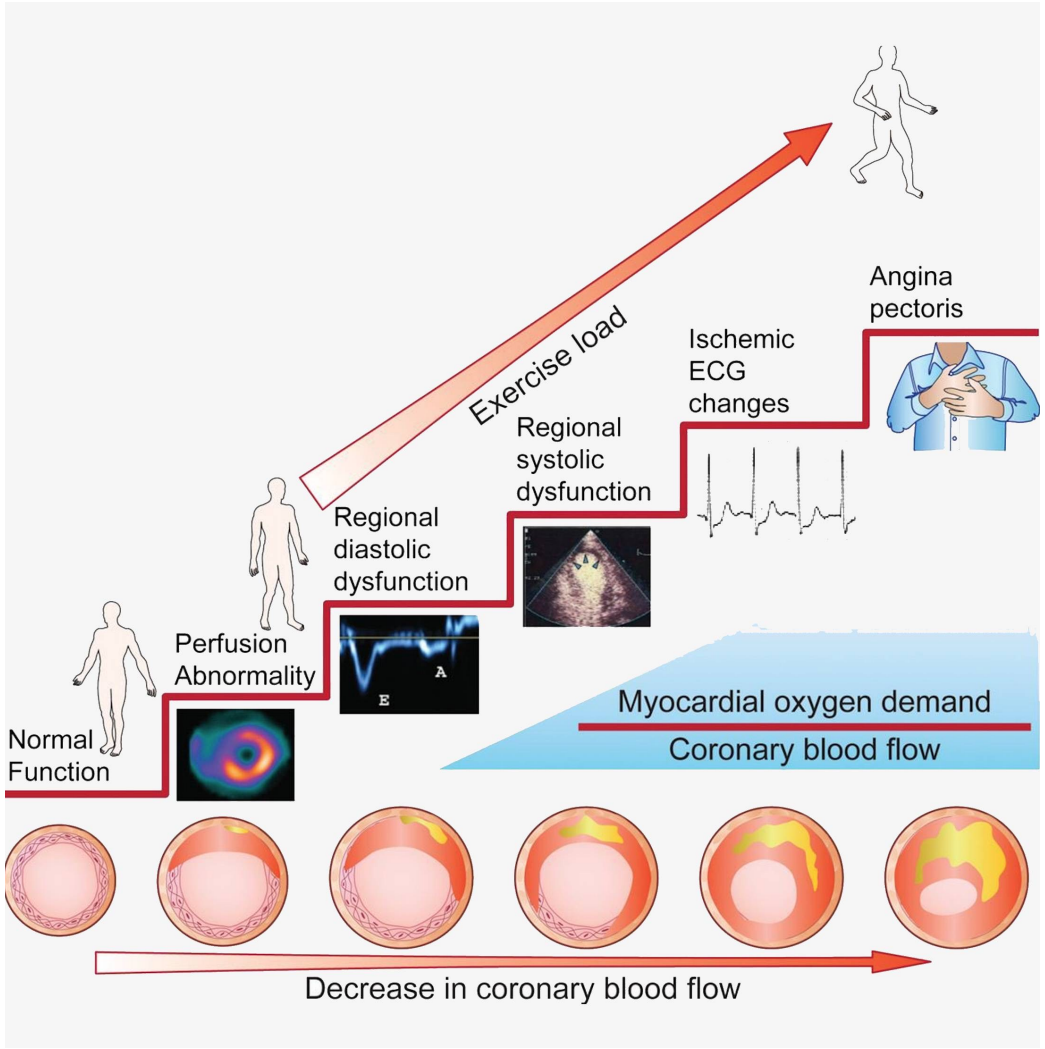
Hypertrophic cardiomyopathy

Severe coronary artery stenosis

Microvasclar circulatory disease

Ischemic Heart Disease

Ischemic cascade in coronary artery disease



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Angina pectoris

Typical angina pectoris:

1. Constricting discomfort in the front of the chest or in the neck, shoulder or arm
2. Precipitated by physical exertion or emotional stress
3. Relieved by rest or nitrates within 5 min

Atypical angina

- Meets only 2 of the typical angina characteristics

Non- anginal chest pain

- Meets only 1 of the typical angina characteristics

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Canadian Cardiovascular Society (CCS) grading of angina on effort

I	Angina only with strenuous exertion	Presence of angina during strenuous, rapid, or prolonged ordinary activity (walking or climbing the stairs).
II	Angina with moderate exertion	Slight limitation of ordinary activities when they are performed rapidly, after meals, in cold, in wind, under emotional stress, or during the first few hours after waking up, but also walking uphill, climbing more than one flight of ordinary stairs at a normal pace, and in normal conditions.
III	Angina with mild exertion	Having difficulties walking one or two blocks, or climbing one flight of stairs, at normal pace and conditions.
IV	Angina at rest	No exertion needed to trigger angina.

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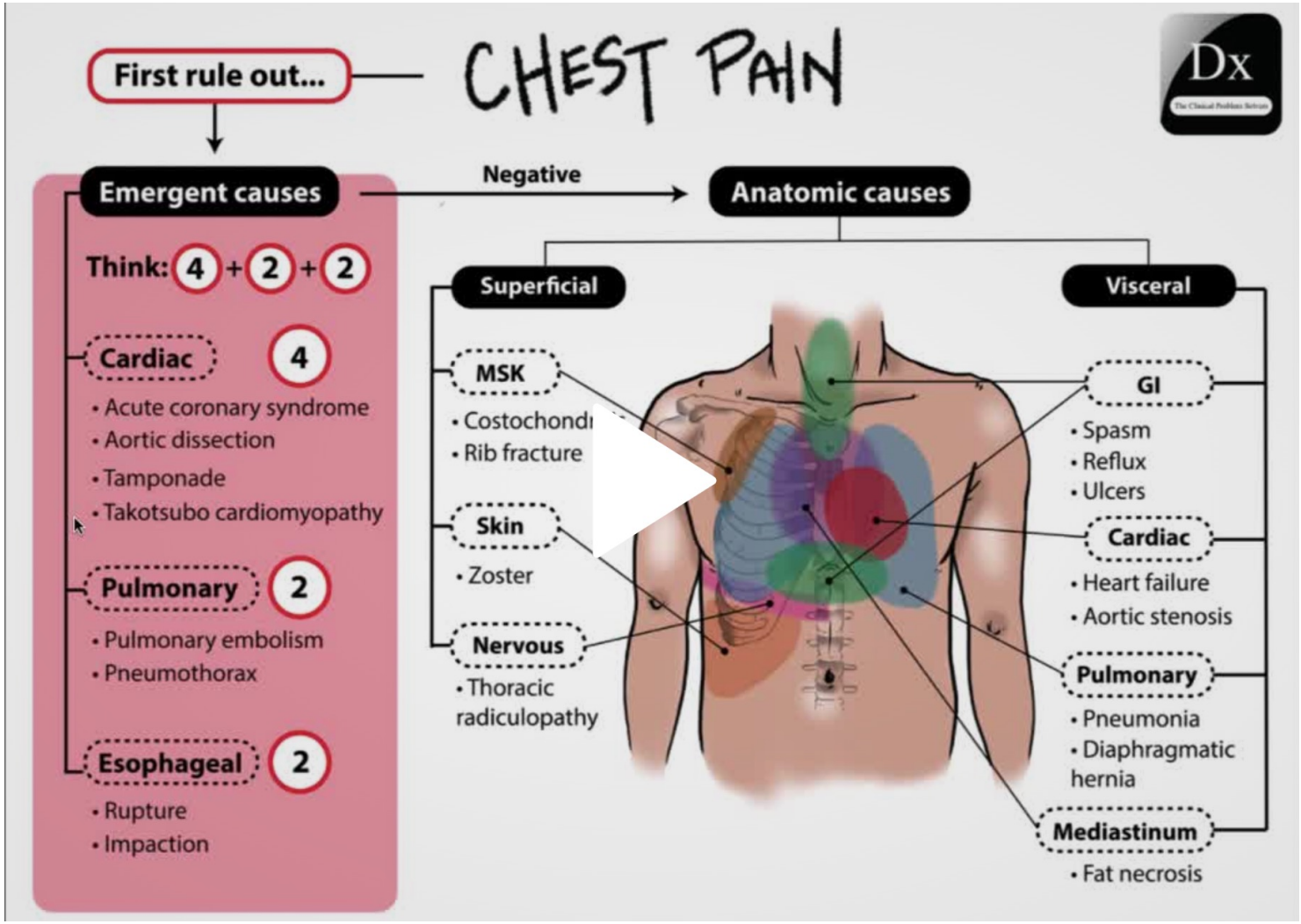
Chest pain: differential diagnosis



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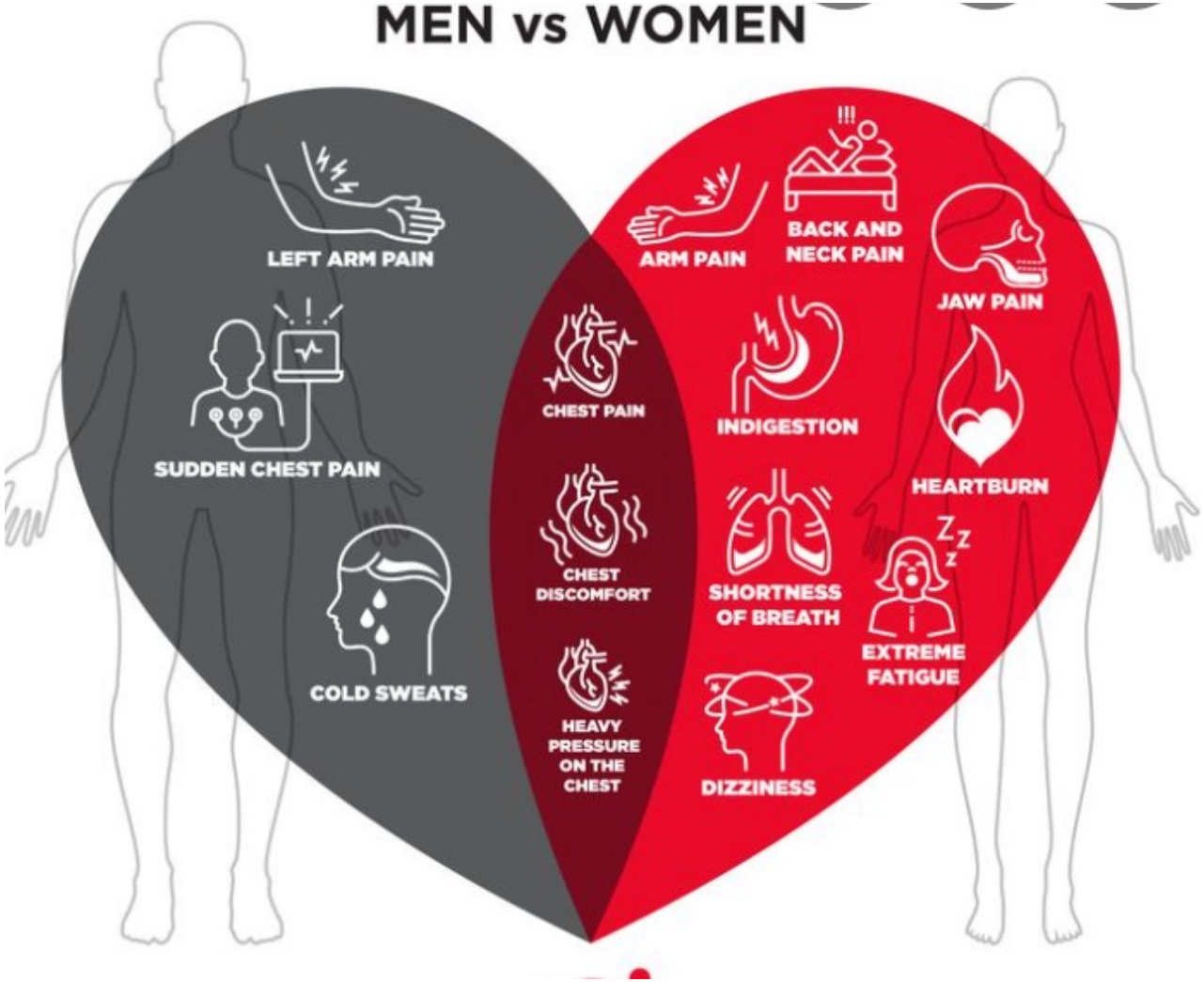
Chest pain and sex



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Chronic coronary syndromes

6 different clinical scenarios:

(i) patients with suspected CAD and 'stable' anginal symptoms, and/or dyspnoea;
(ii) patients with new onset of HF or LV dysfunction and suspected CAD;
(iii) asymptomatic and symptomatic patients with stabilized symptoms <1 year after an ACS or patients with recent revascularization;
(iv) asymptomatic and symptomatic patients >1 year after initial diagnosis or revascularization;
(v) patients with angina and suspected vasospastic or microvascular disease;
(vi) asymptomatic subjects in whom CAD is detected at screening.

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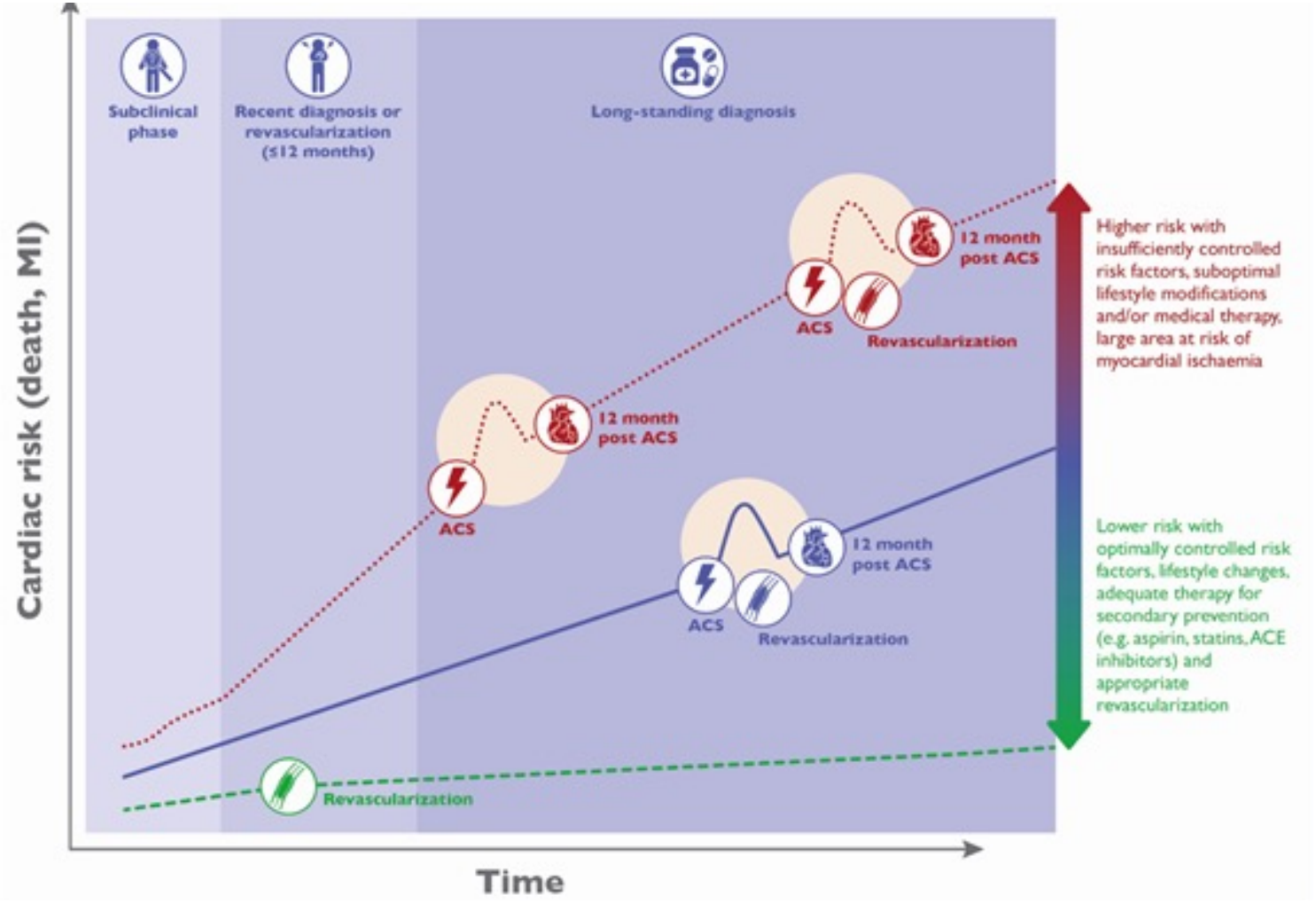
Natural history of chronic coronary syndromes



ESC guidelines for management of chronic coronary syndromes. Eur Heart J 2019

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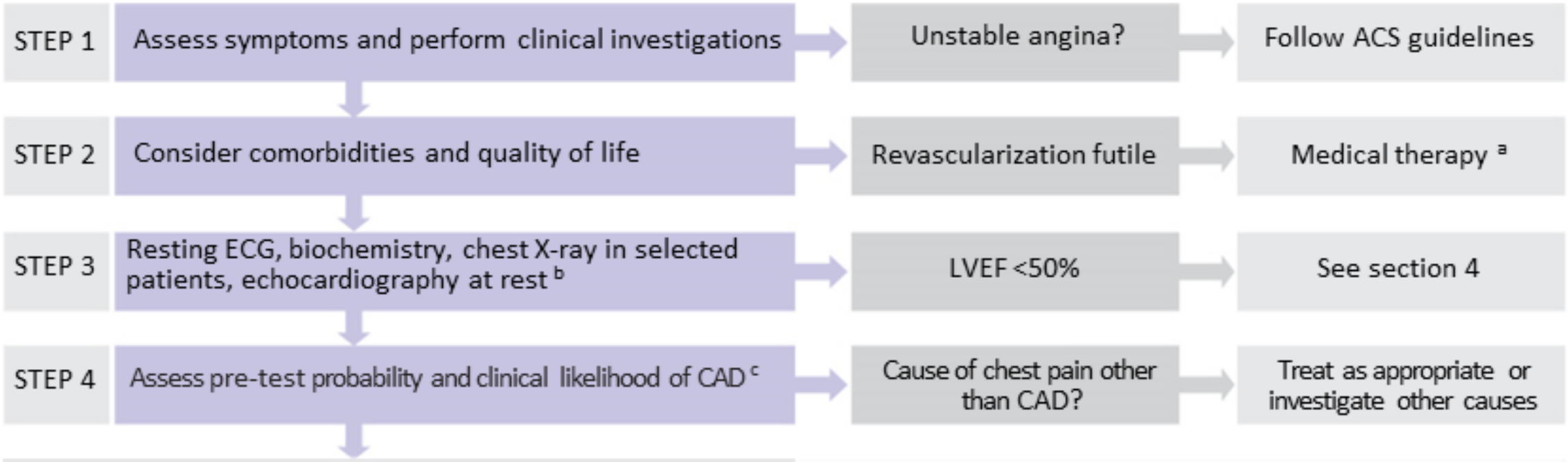
Diagnostic approach



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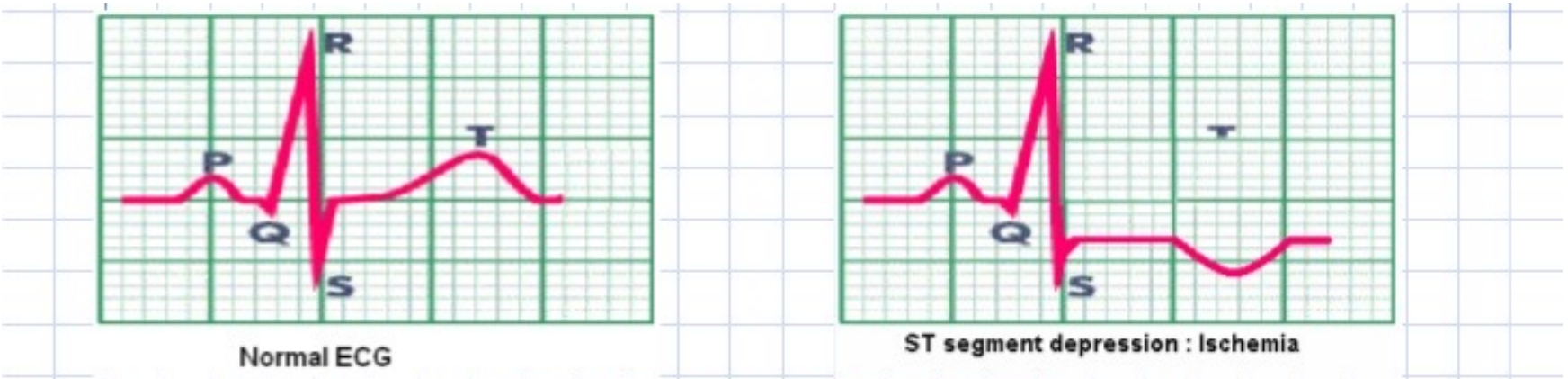
Electrocardiogram



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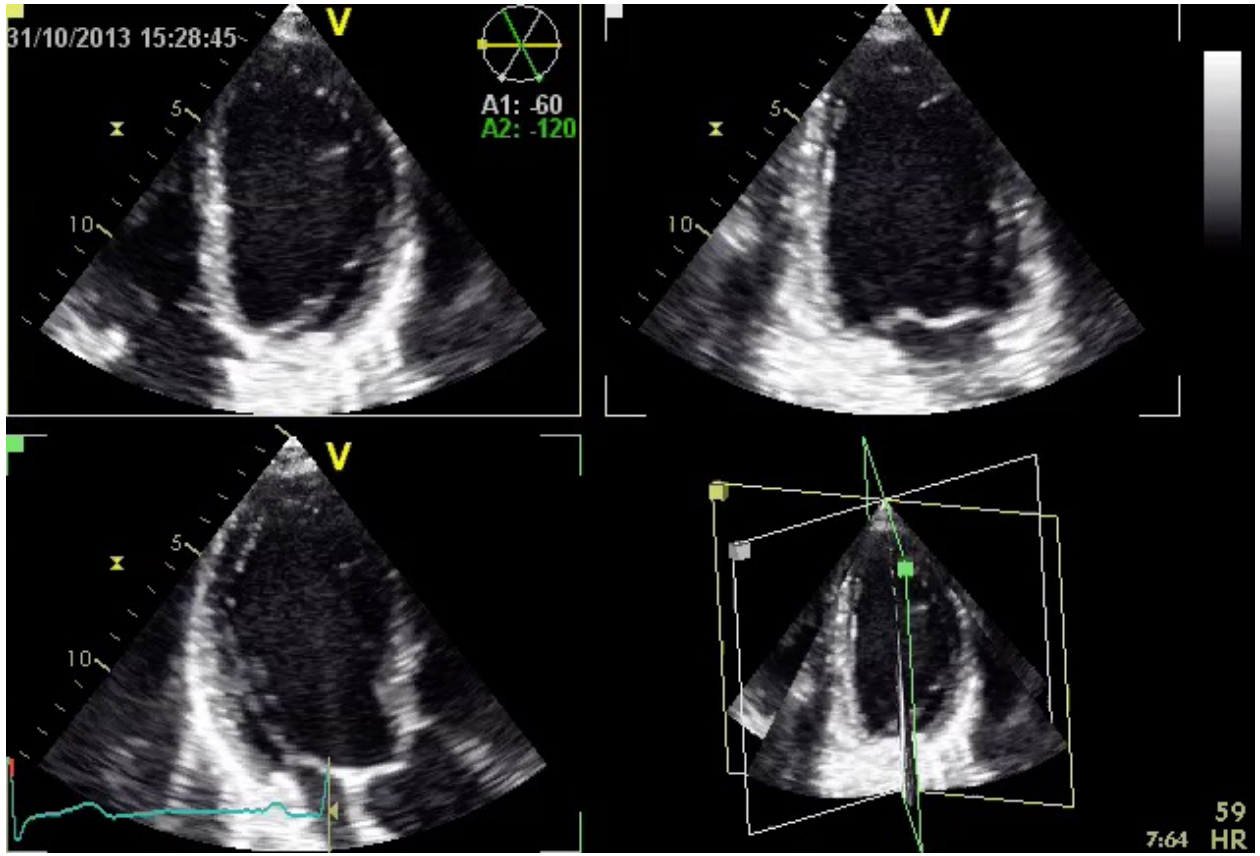
Echocardiography



Resting echocardiography indicated to:

1. Exclude alternative causes of angina
2. Identify regional wall motion abnormalities suggestive of coronary artery disease
3. Measure left ventricular ejection fraction for stratification purposes
4. Evaluate left ventricular diastolic function

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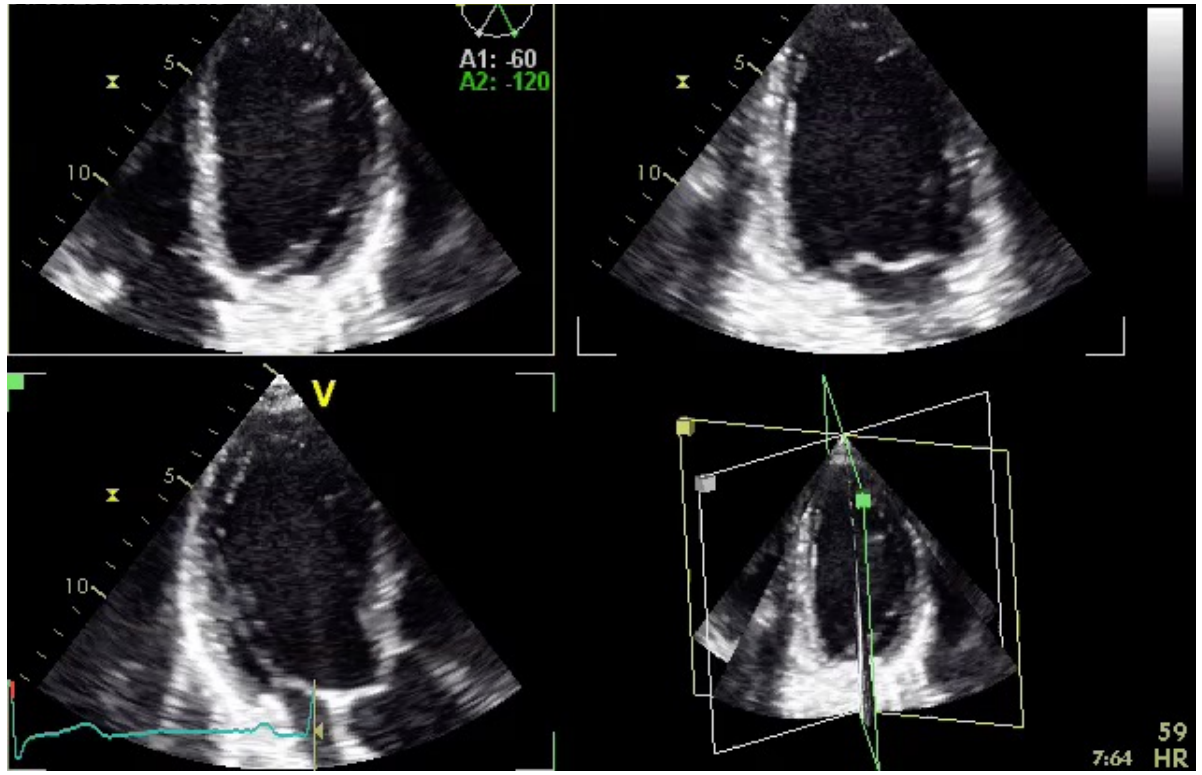
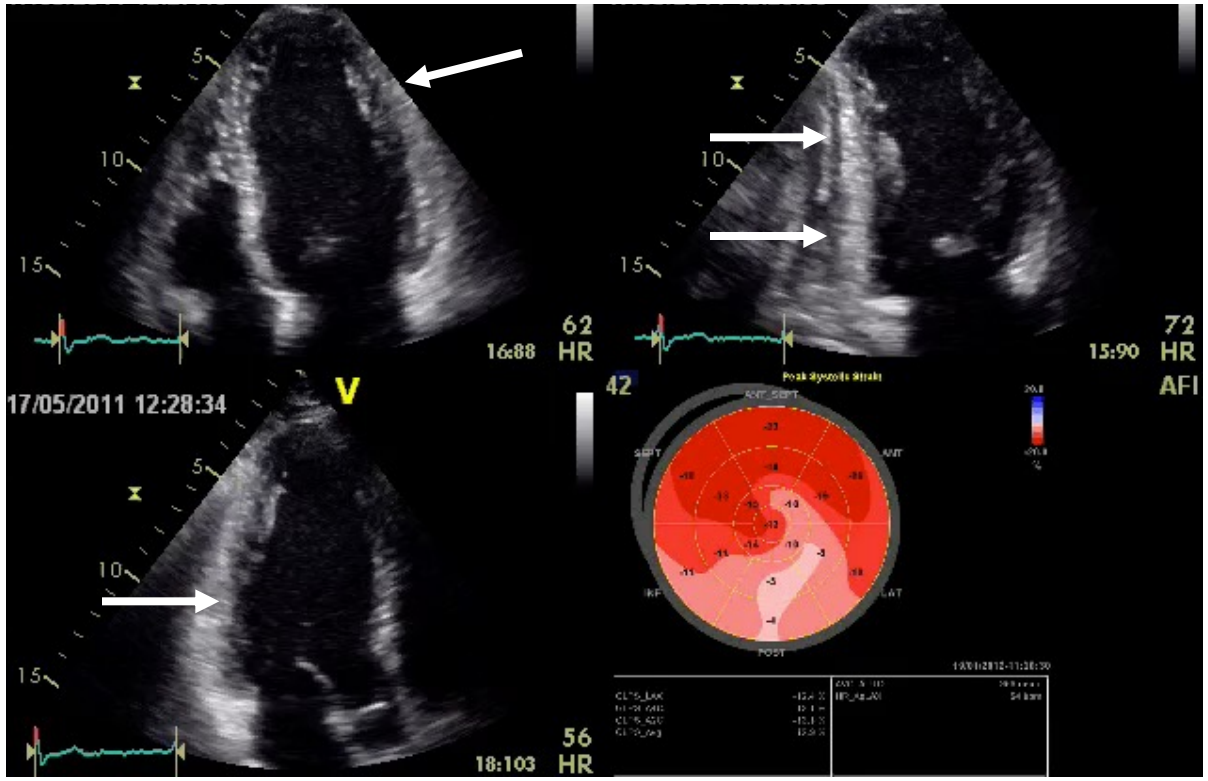
Echocardiography



Healthy subject



Chronic coronary syndrome

- Global left ventricular dysfunction
- Regional wall motion abnormalities (arrows)

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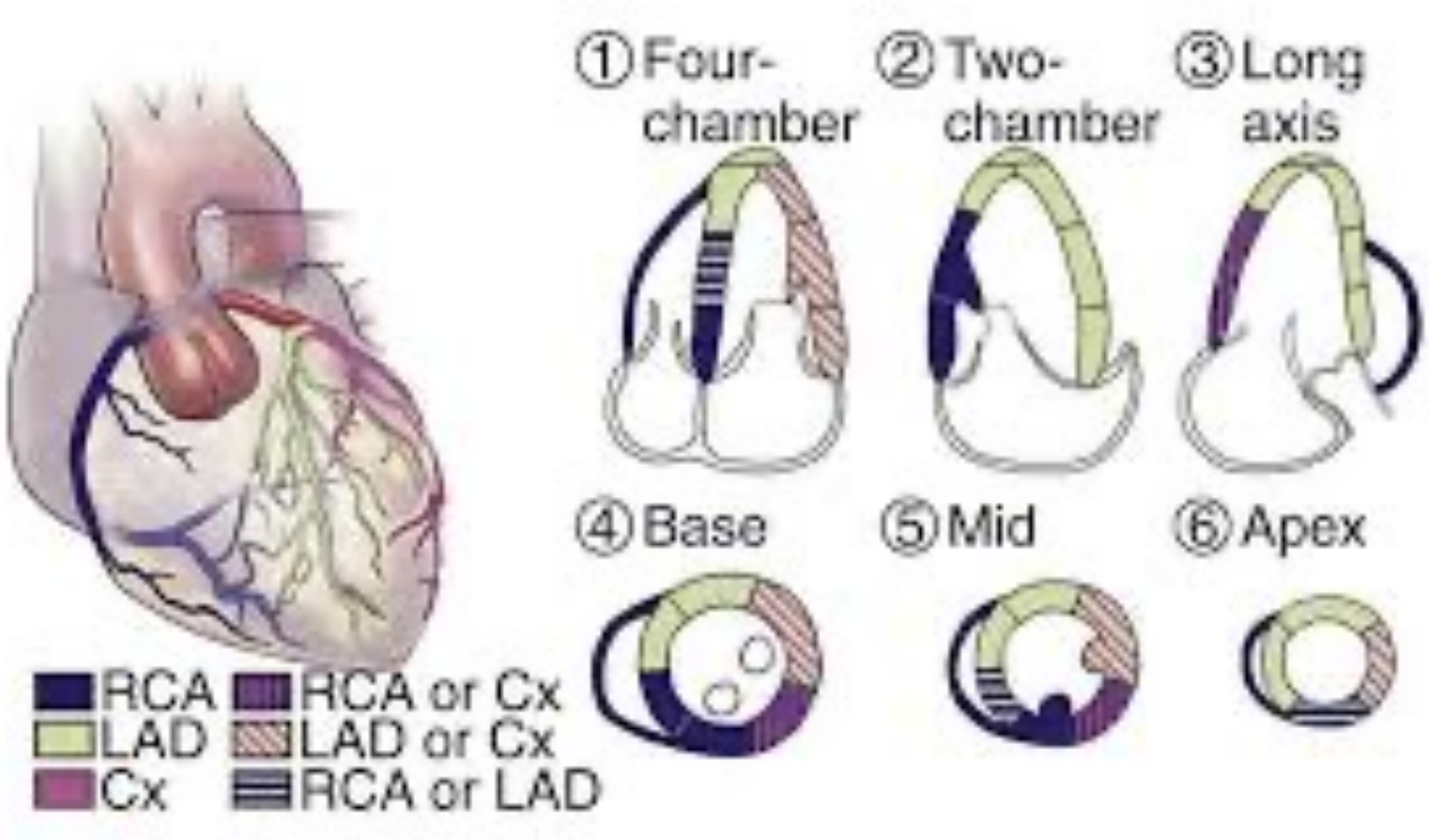
Echocardiography



SCHOOL OF MEDICINE AND SURGERY

DIPARTIMENTO DI MEDICINA E CHIRURGIA

Lang RM, Badano LP, et al . J Am Soc Echocardiogr 2015; 28: 1-39

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

Ischemic Heart Disease

Pre-test probability of coronary artery disease

	Typical		Atypical		Non-anginal			Dyspnoea[a]	
Age	M	W	M	W	M	W		M	W
30–39	3%	5%	4%	3%	1%	1%		0%	3%
40–49	22%	10%	10%	6%	3%	2%		12%	3%
50–59	32%	13%	17%	6%	11%	3%		20%	9%
60–69	44%	16%	26%	11%	22%	6%		27%	14%
70+	52%	27%	34%	19%	24%	10%		32%	12%

[a] In addition to the classic Diamond and Forrester classes, patients with dyspnoea only or dyspnoea as the primary symptom are included. The dark green shaded regions denote the groups in which non-invasive testing is most beneficial (pre-test probability >15%). The light green shaded regions denote the groups with pre-test probability of CAD between 5-15% in which the testing for diagnosis may be considered after assessing the overall clinical likelihood based on modifiers of pre-test probability.

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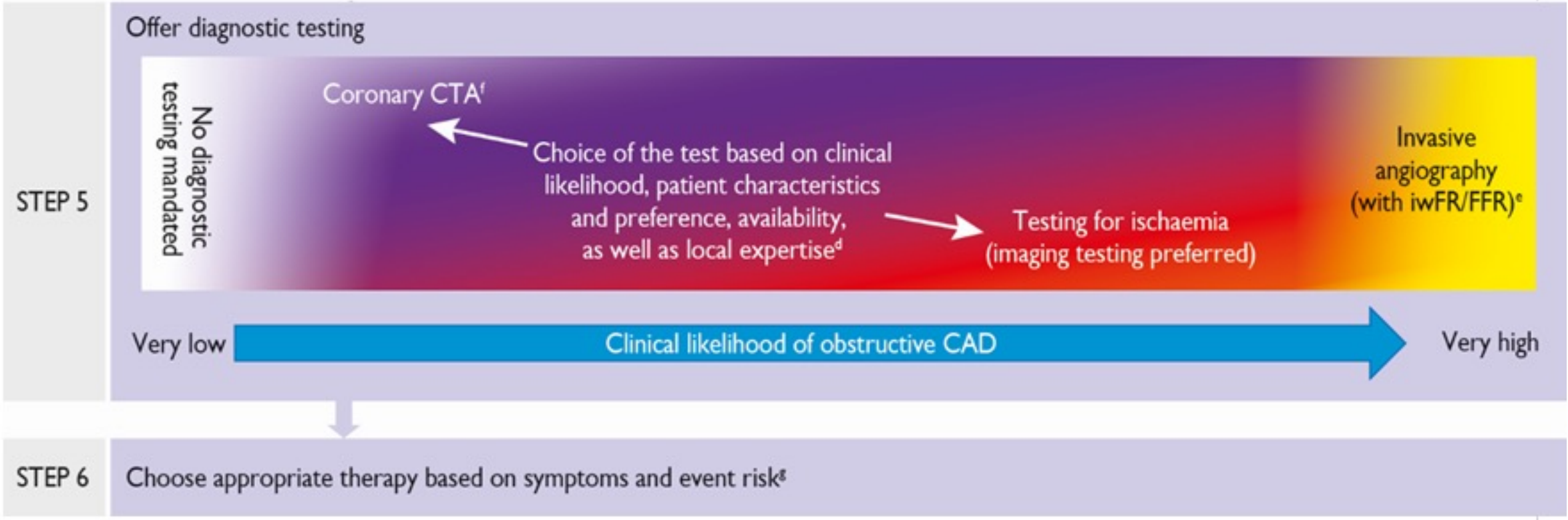
Diagnostic approach



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Computed Tomographic Coronary Angiography

CCT angiography provides high resolution imaging of the heart and give good visualization of the coronary arteries

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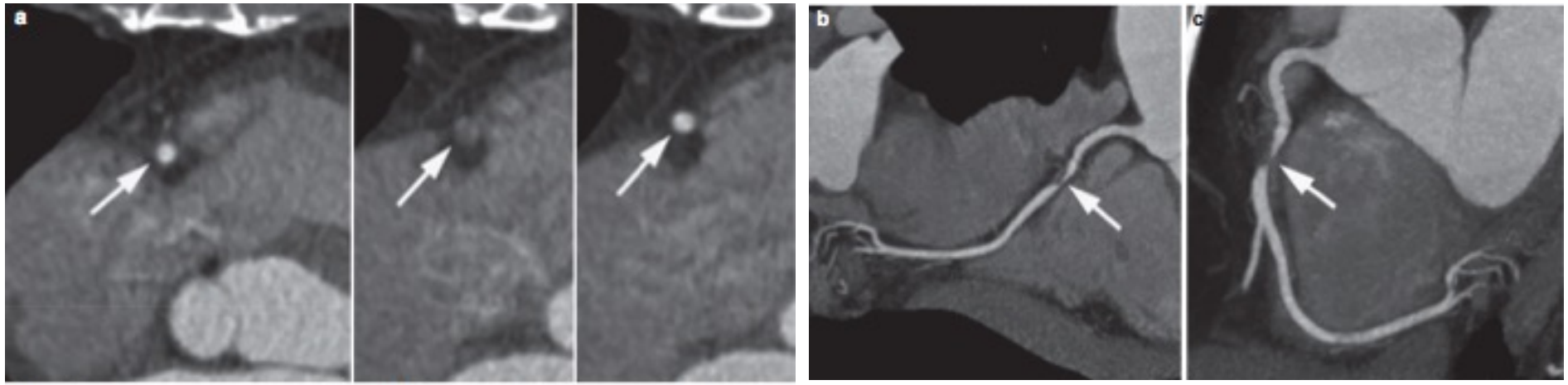
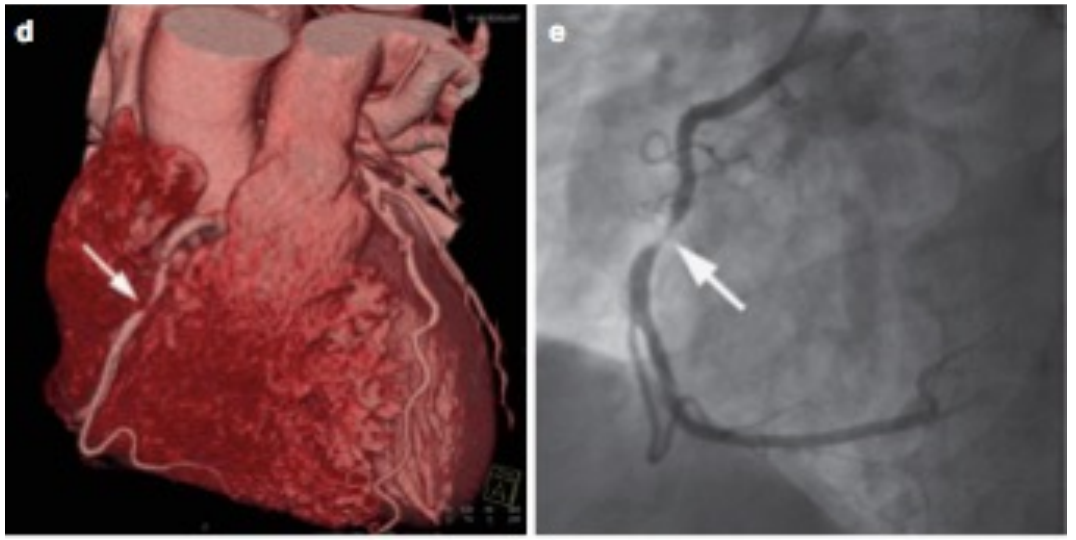
Cardiac CT angiography detection of CAD





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Cardiac CT angiography detection of CAD

Pre-test probability*	nr	Sensitivity	Specificity	Pos. Predictive Value	Neg. Predictive Value
High	105	98%	74%	93%	89%
Intermediate	83	100%	84%	80%	100%
Low	66	100%	93%	75%	100%

* Estimated with the Duke clinical risk score

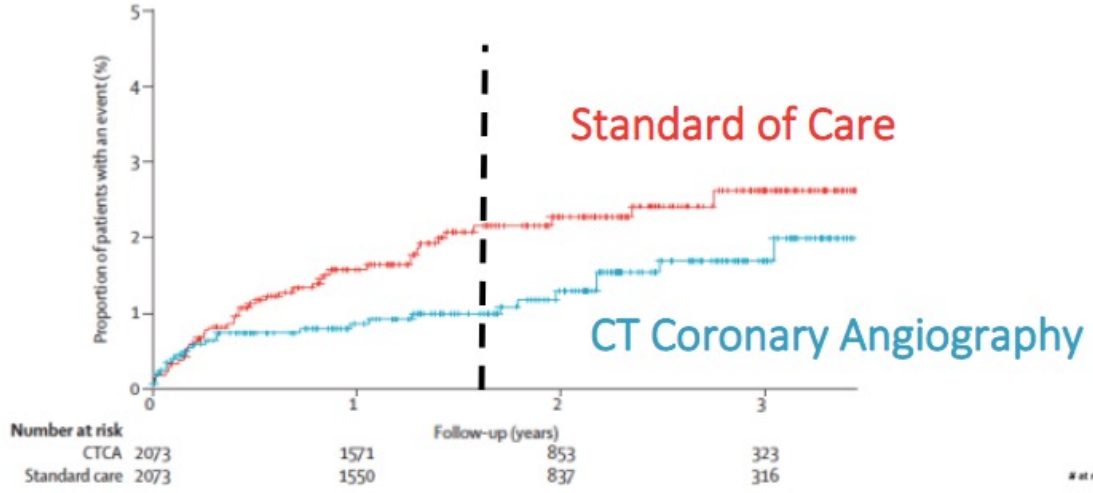
Meijboom WB et al. J Am Coll Cardiol 2007

Ischemic Heart Disease

Effects of CTC angiography on clinical outcomes

The SCOT-HEART Trial

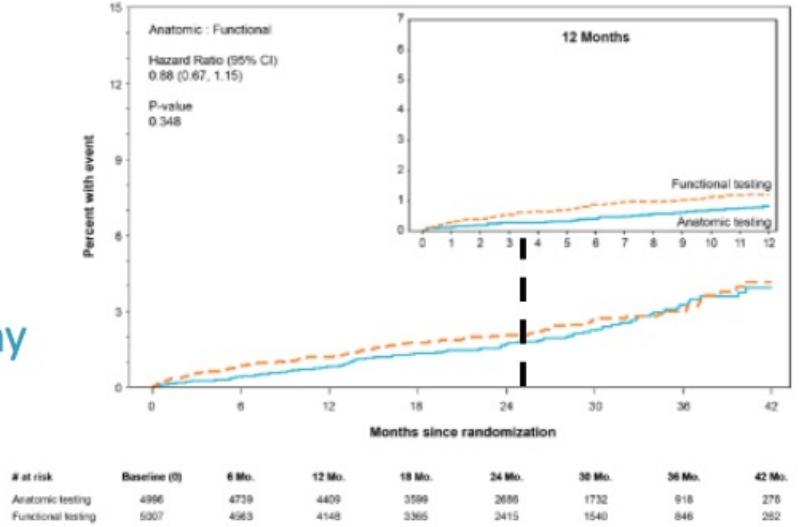
CHD death or non-fatal myocardial infarction
HR 0.62 (95% CI, 0.38-1.01), P=0.053



The SCOT-HEART Inv. Lancet 2015

The promise Trial

Death or non-fatal myocardial infarction
HR 0.66 (95% CI, 0.44-1.00), P=0.049



Douglas P et al. N Engl J Med 2015

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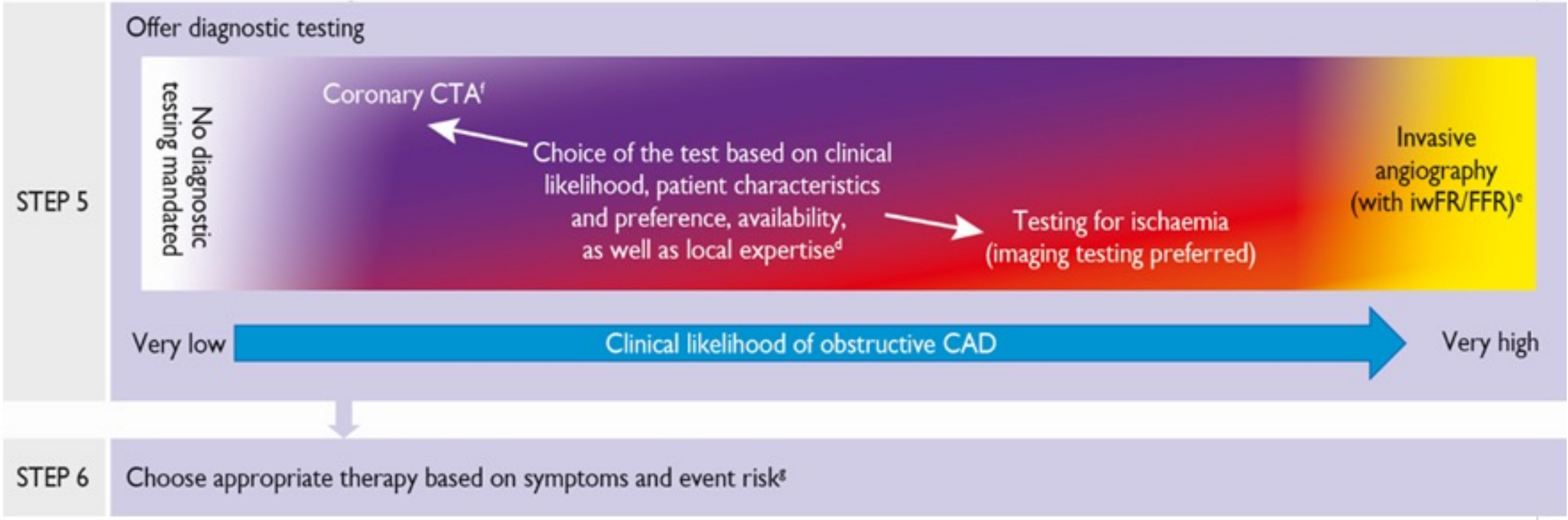
Diagnostic approach



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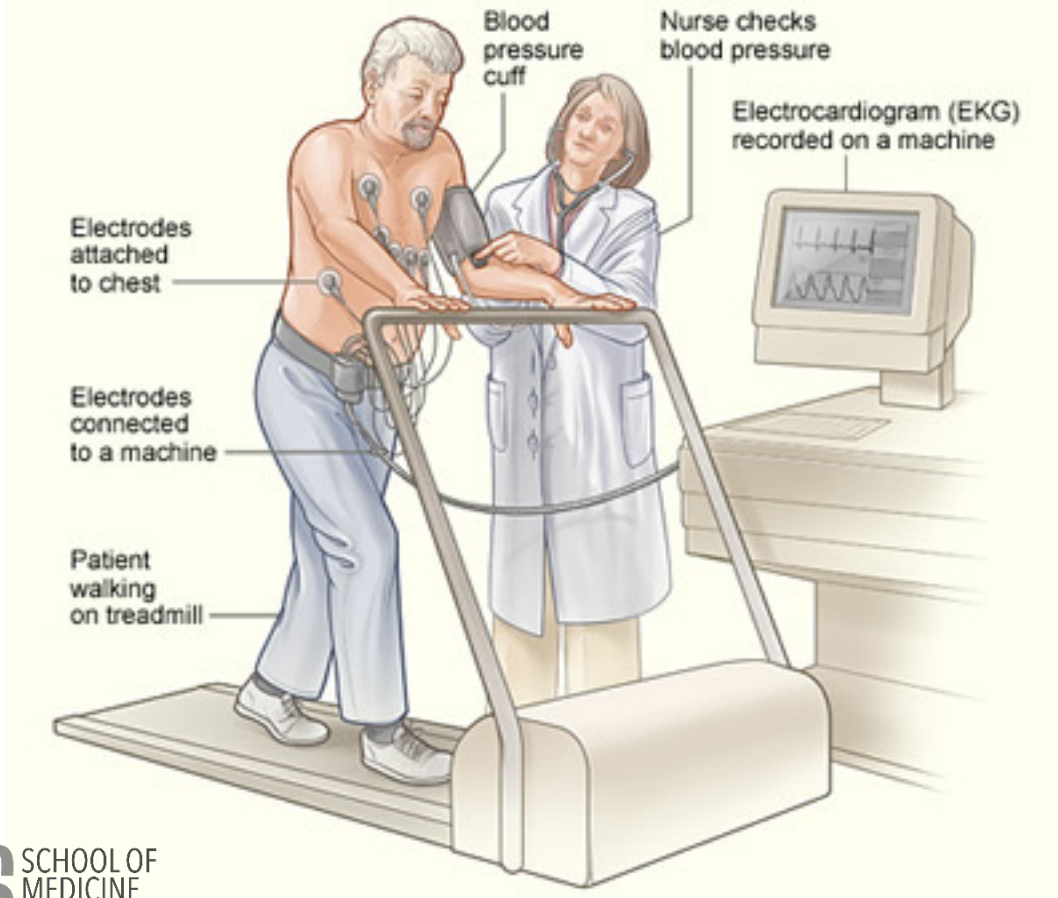
Electrocardiography stress test



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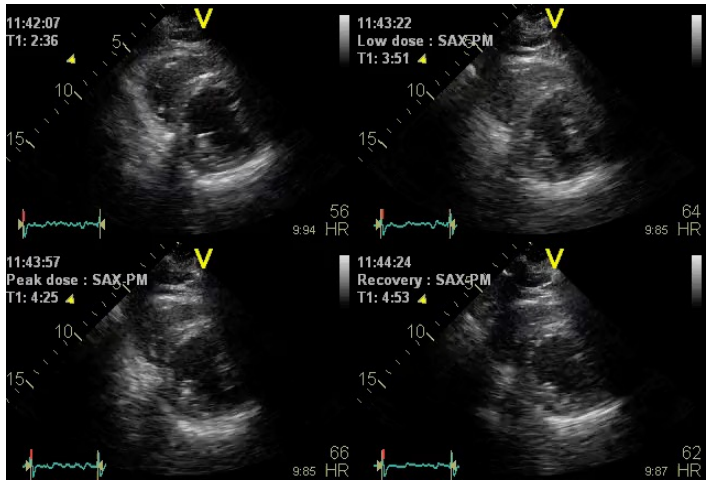
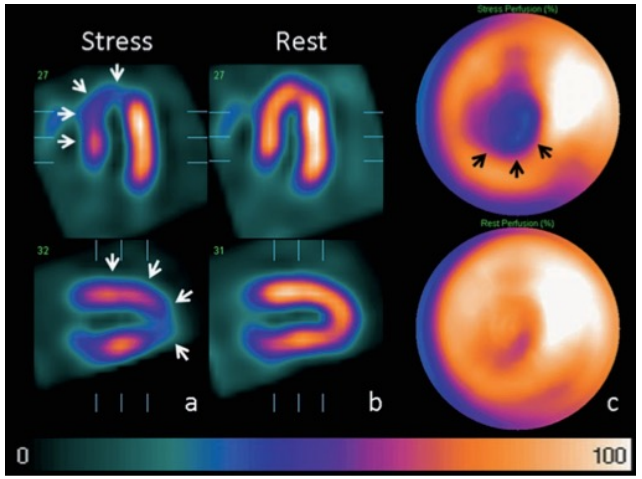
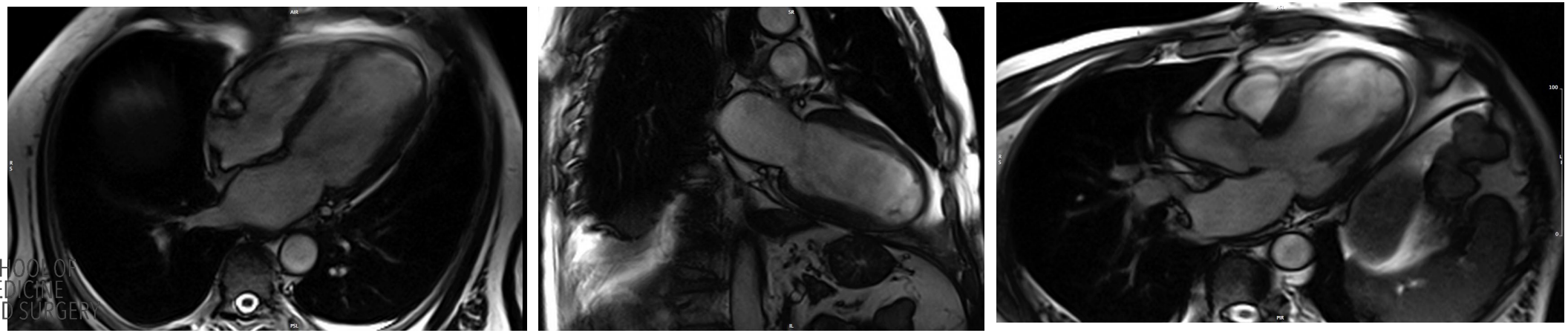
Imaging stress test



Stress echo (exercise or pharmacological)



Stress SPECT



Cardiac Magnetic Resonance

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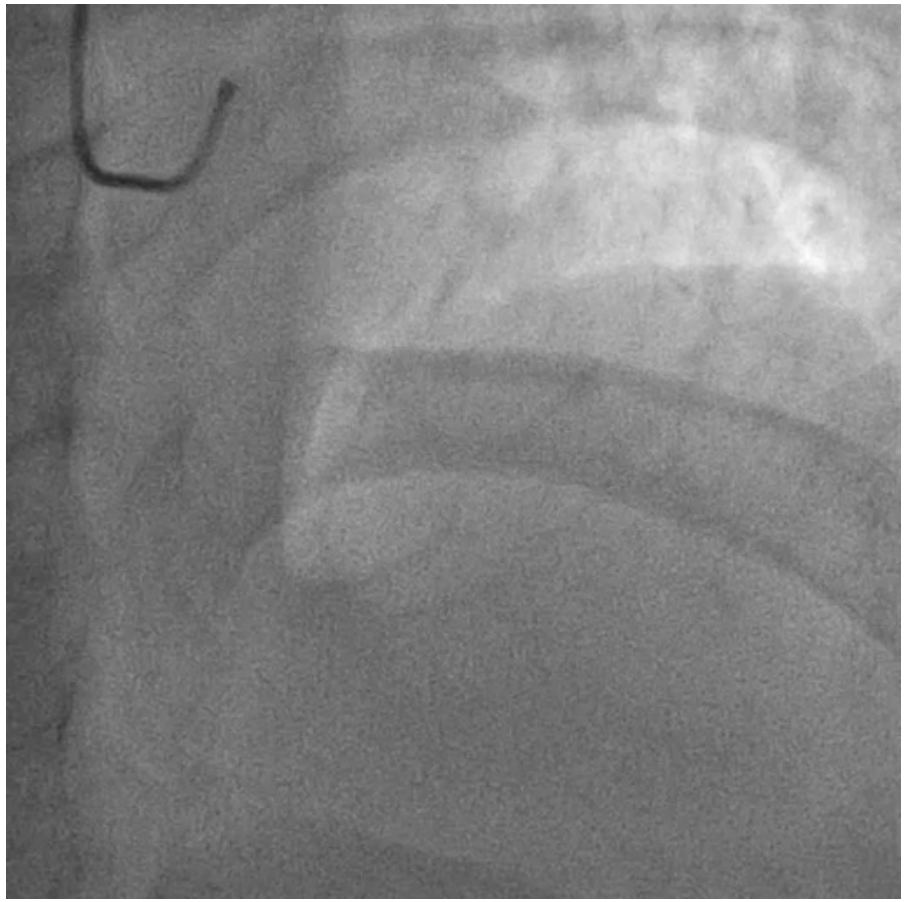
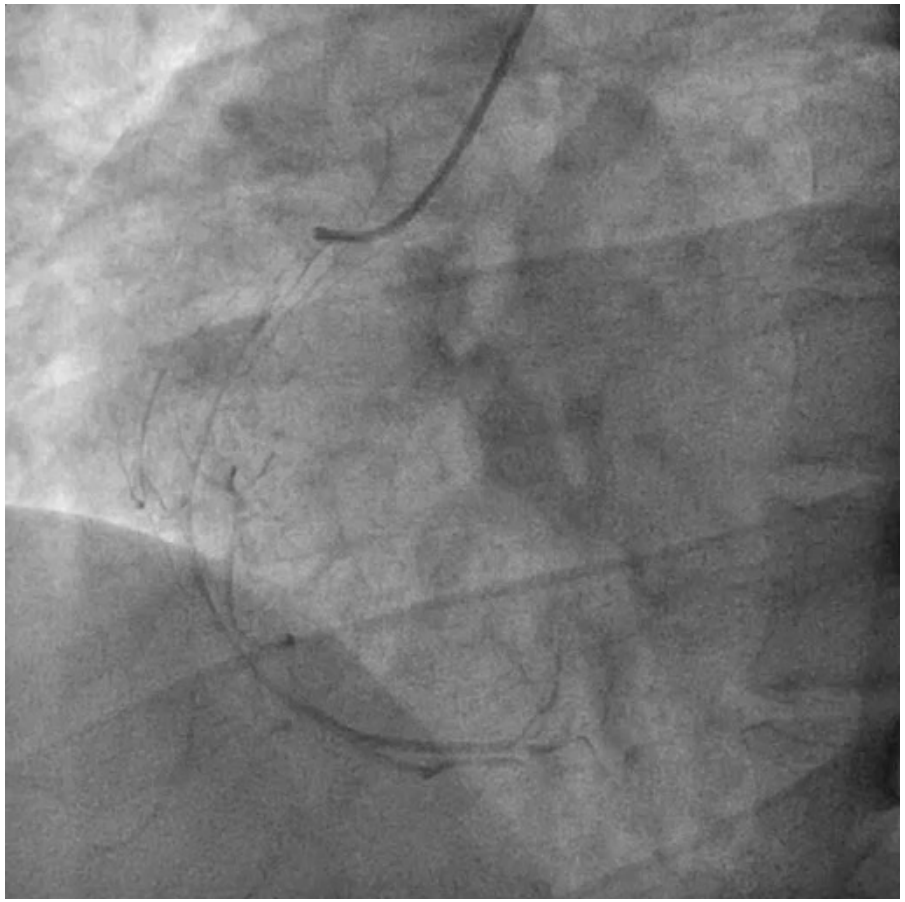
Invasive coronary angiography (normal)



Left coronary artery



Right coronary artery

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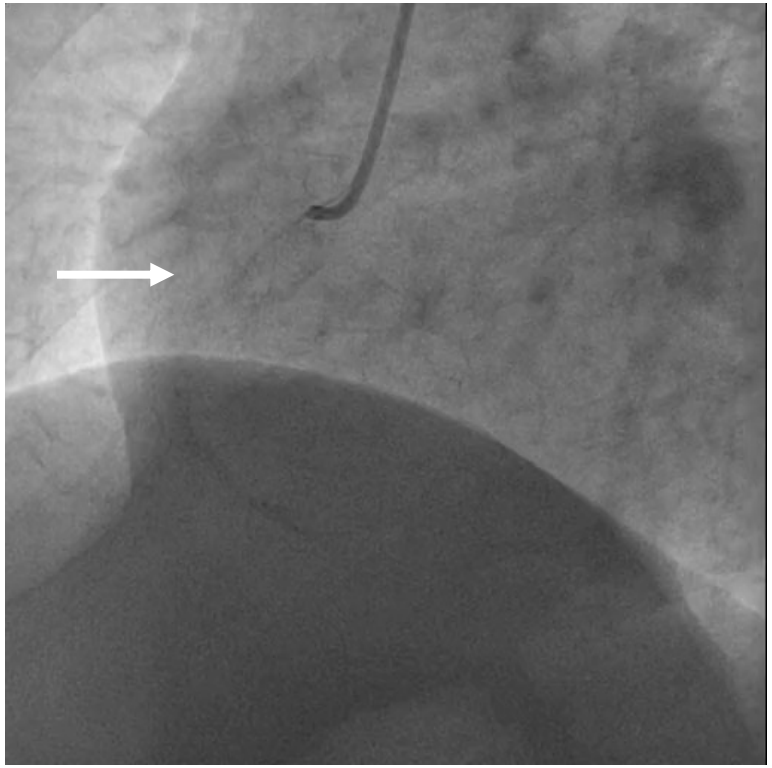
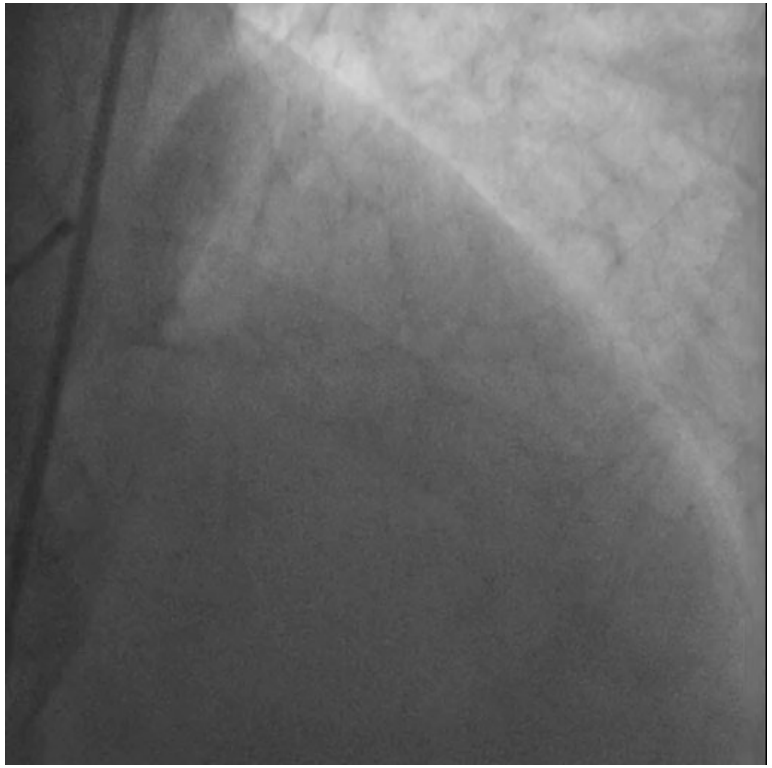
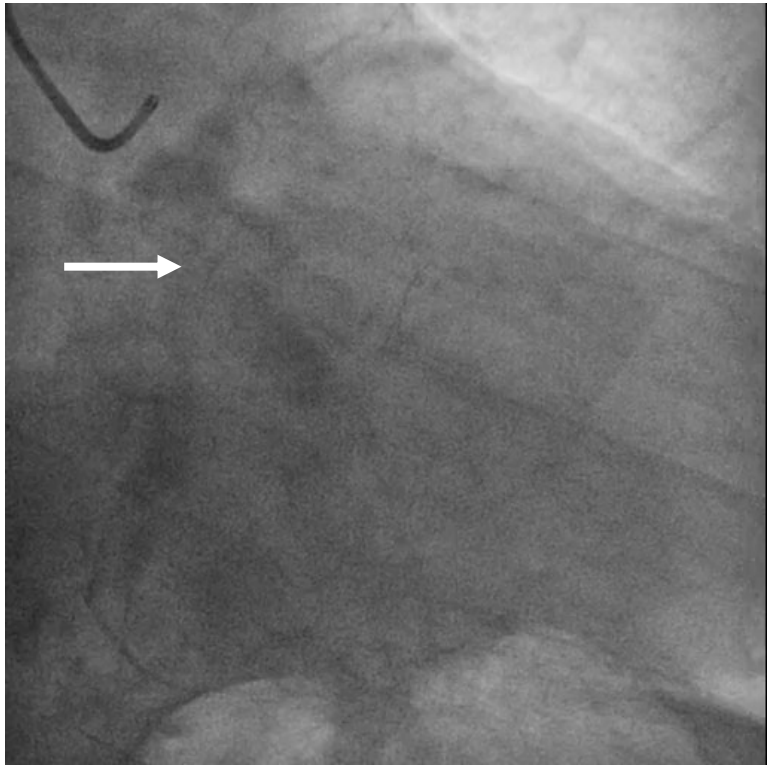
Invasive coronary angiography (two-vessel disease)



Right coronary artery



Left anterior descending branch



Circumflex branch

Ischemic Heart Disease

Treatment

Recommendations	Class	Level
General considerations		
Medical treatment of symptomatic patients requires one or more drug(s) for angina/ischaemia relief in association with drug(s) for event prevention.	I	C
It is recommended that patients are educated about the disease, risk factors, and treatment strategy.	I	C
Timely review of the patient's response to medical therapies (e.g. 2-4 weeks after drug initiation) is recommended.	I	C

* ASA is class I only in patients with previous myocardial infarction or previous revascularization

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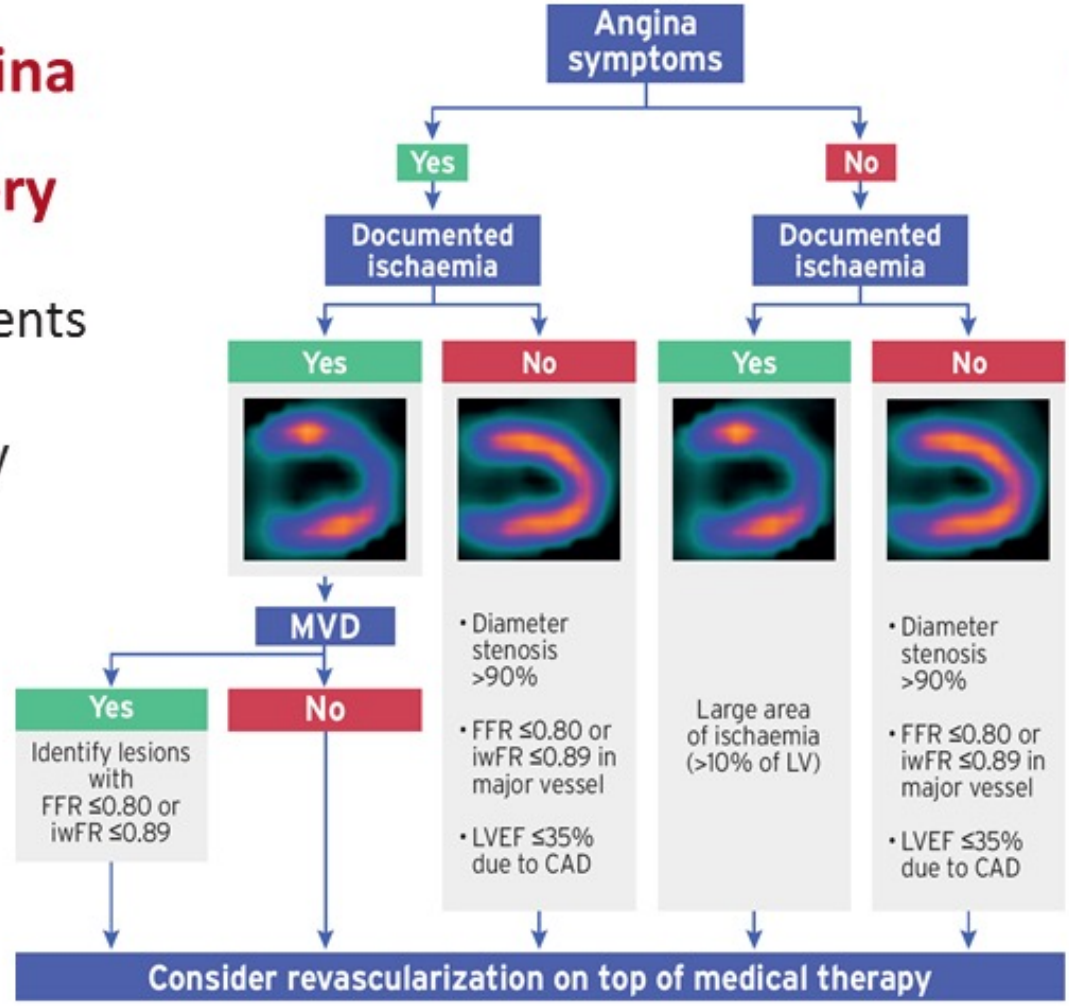
Treatment

Patients with angina and/or dyspnoea and coronary artery disease

Decision tree for patients undergoing invasive coronary angiography



CAD = coronary artery disease;
FFR = fractional flow reserve;
iwFR = instantaneous wave-free ratio;
LV = left ventricle;
LVEF = left ventricular ejection fraction;
MVD = multivessel disease.

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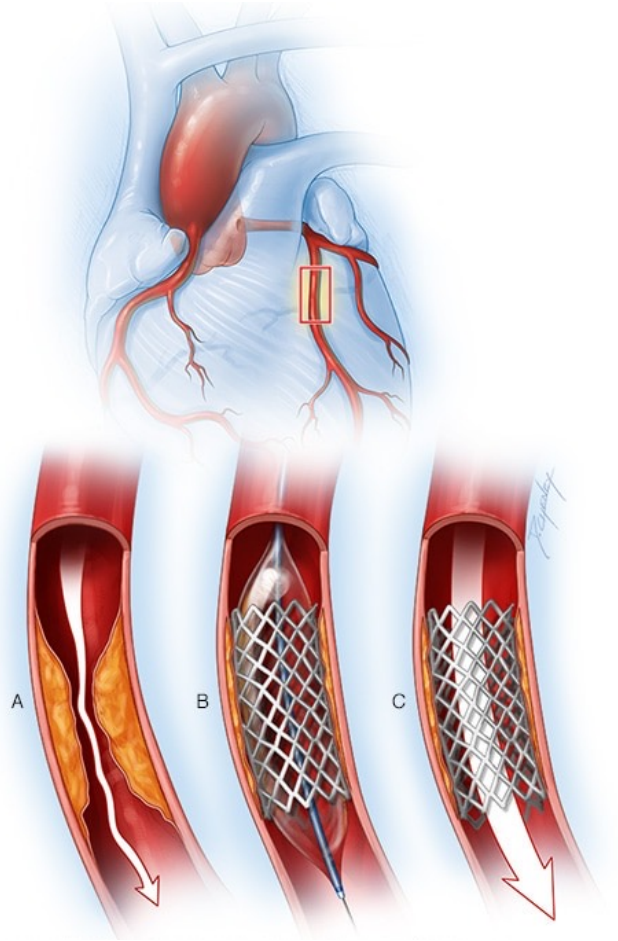
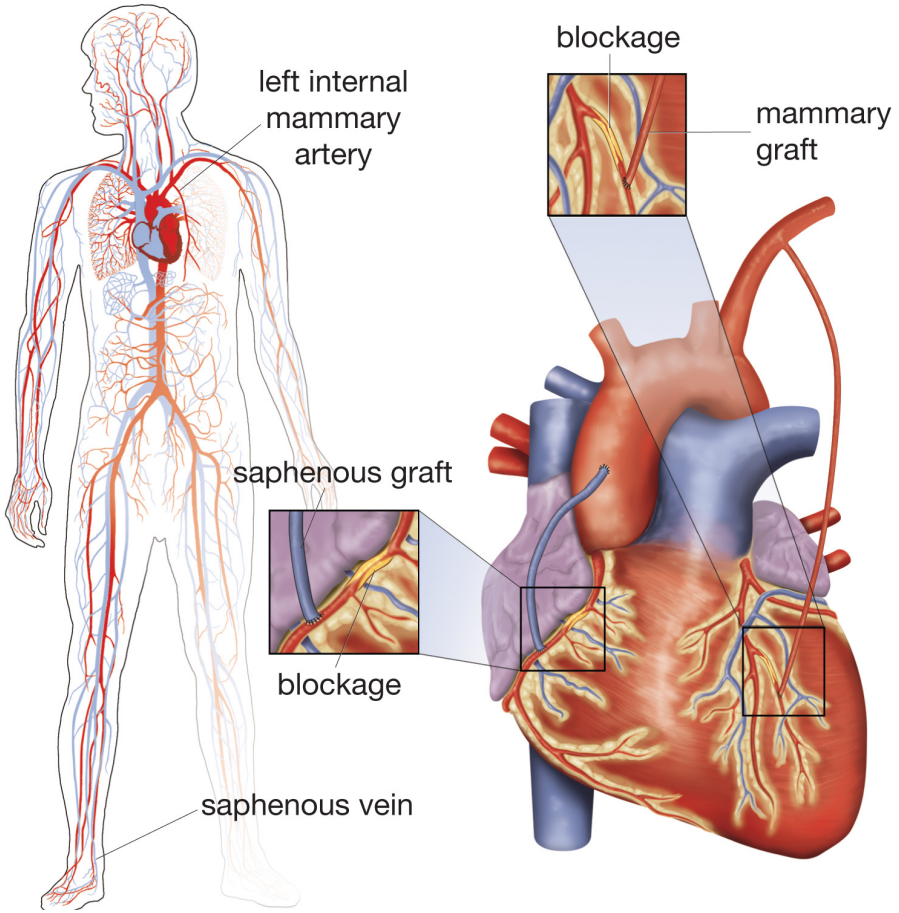
Myocardial revascularization



Percutaneous coronary intervention



Coronary artery bypass

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THANK YOU!

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