

Ischaemic heart disease

IIInd Chair and Clinic of Cardiology

Definition

- Syndrome due to chronic insufficient oxygen supply to myocardial cells
- Nomenclature: ischaemic heart disease (IHD), coronary artery disease (CAD), angina pectoris

CAD classification

- **1. stable coronary syndromes**
 - Stable angina
 - Prinzmetal's angina (variant angina)
 - Cardiac X syndrome
 - Angina due to myocardial bridge
- **2. acute coronary syndroms (ACS)**
 - Unstable angina
 - Non-ST elevation myocardial infarction (NSTEMI)
 - ST-elevation myocardial infarction (STEMI)
 - Unclassified myocardial infarction

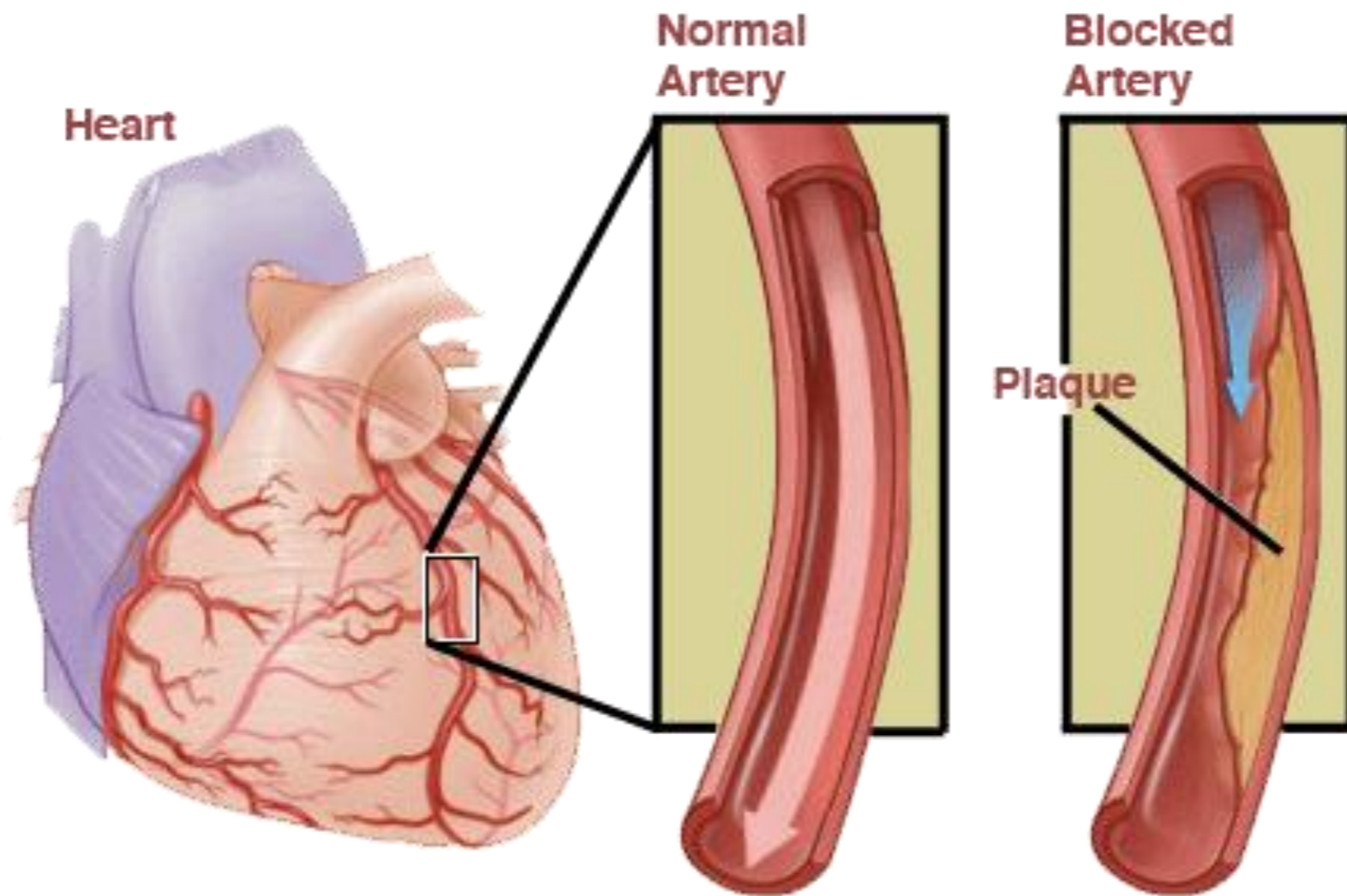
Epidemiology

- Prevalence of IHD in Poland: **620/100 000 males and 220/ 100 000 females.** Morbidity rate is lower in rural estate compared to industrial areas
- Prefalence of angina grows rapidly when aging in both men and women: from 0,1–1% in females aged 45–54 yrs to 10–15% in females aged 65–74 yrs and from 2–5% in males aged 45–54 yrs to 10–20% in males aged 65–74 yrs.

Epidemiology

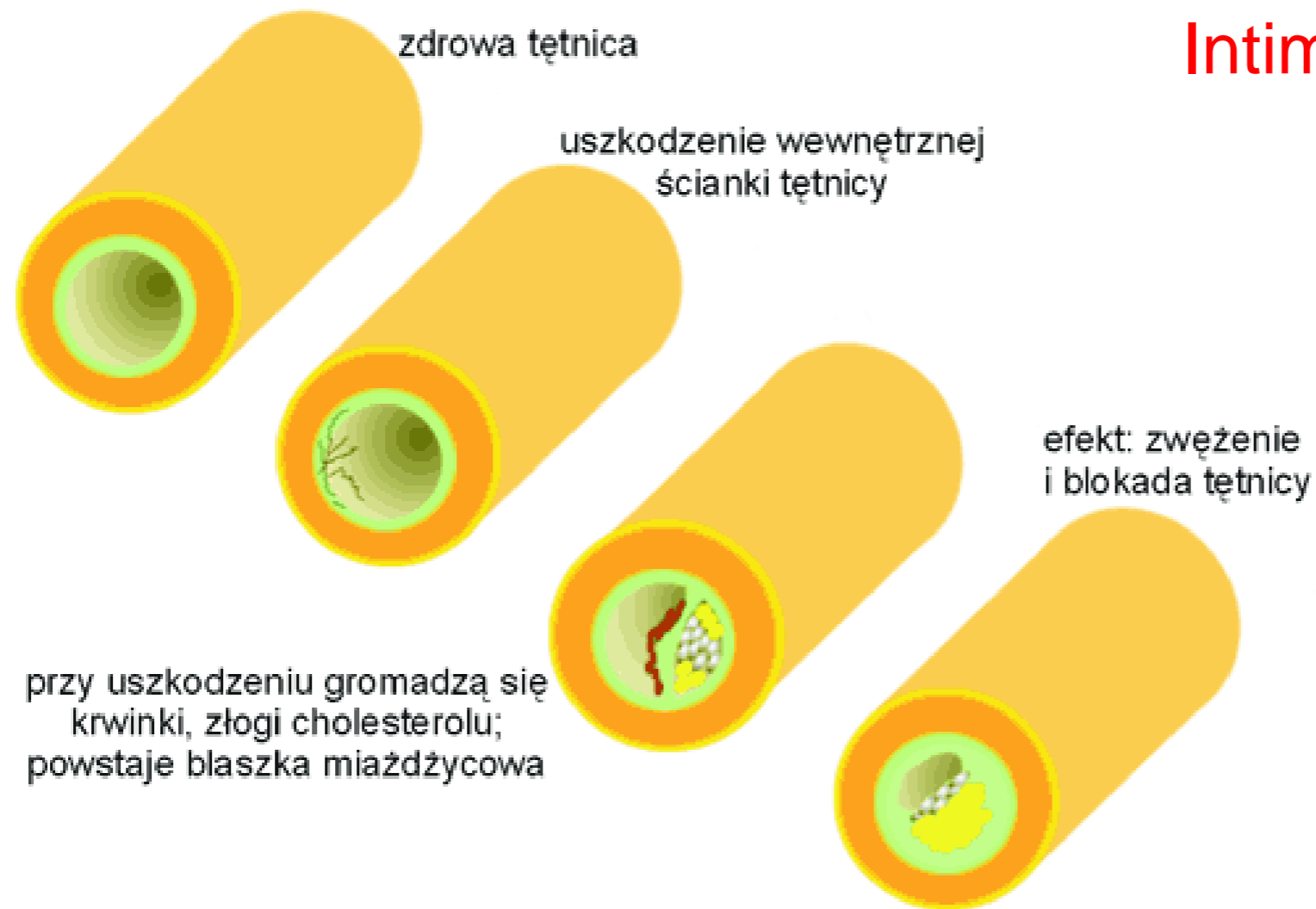
- The most common cause of IHD (>98% cases) is **atherosclerosis of the coronary arteries**
- Other causes:
 - Vasospasm
 - Coronary artery embolism
 - Coronary artery wall inflammation
 - Lesions of the Coronary arteries due to metabolic disorders
 - Congenital vascular malformations
 - Coronary artery injury
 - Arterial thrombosis due to hemostatic disorders
 - Supply/demand mismatch
 - Aortic dissection

Atherosclerotic plaque



Stages of plaque formation

Normal artery

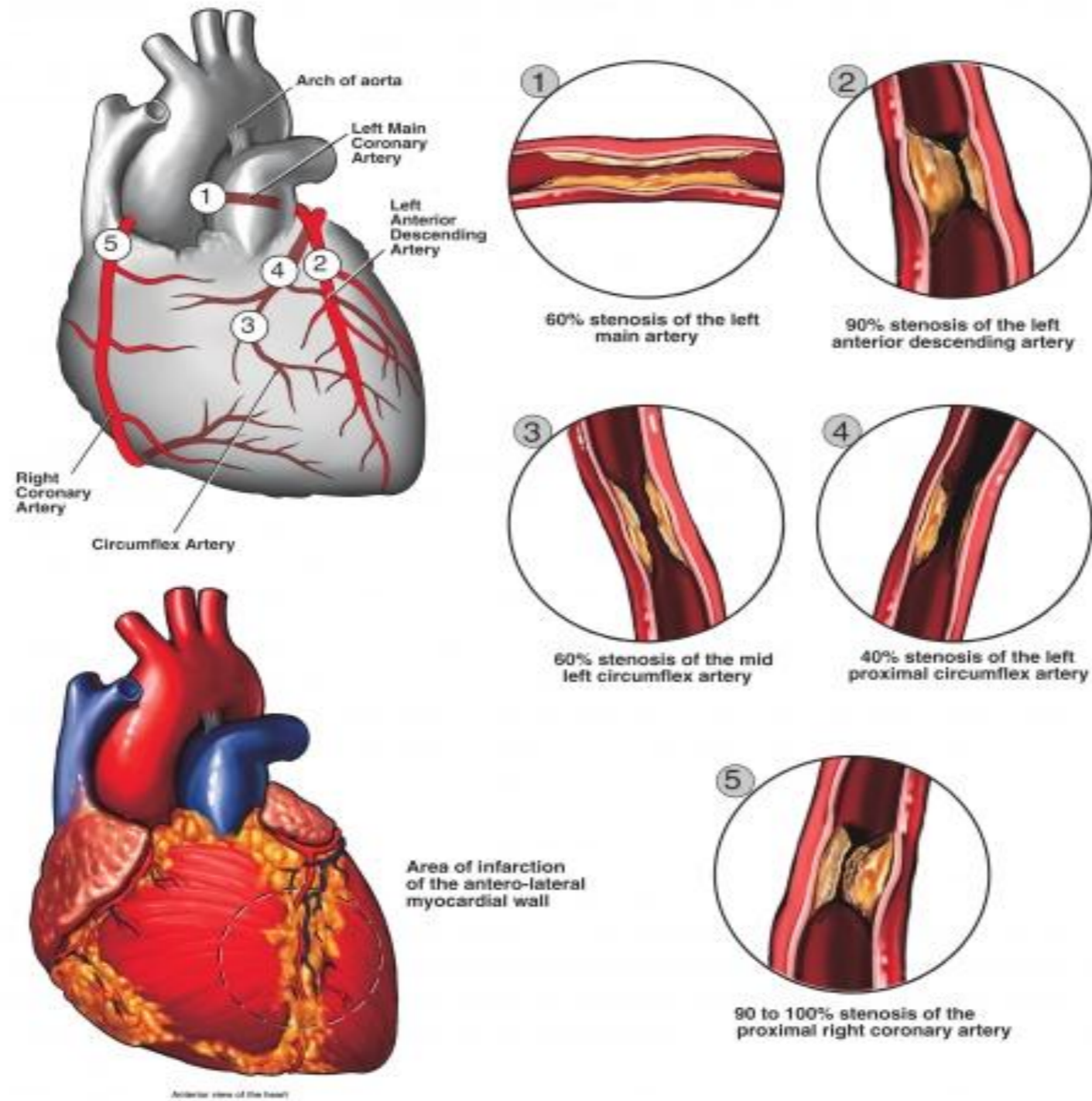


Intima lesion

Subsequent artery narrowing and obstruction

Blood cells and cholesterol accumulation – creation of the plaque

Arterial atherosclerosis

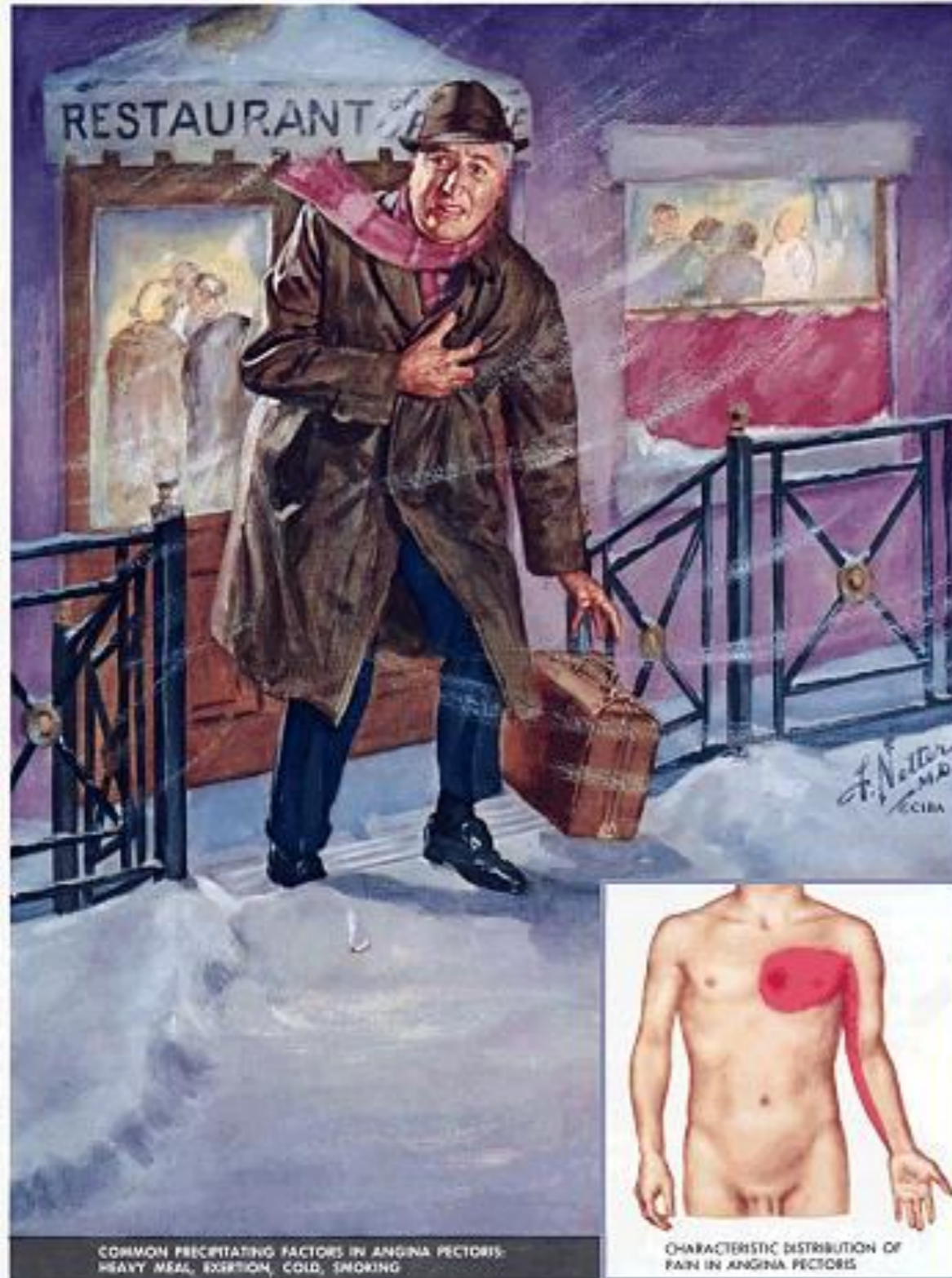


Risk factors

- Known arteriosclerosis
- Age
- Family history of IHD
- Dyslipidemia
- Smoking
- Diabetes
- Arterial hypertension
- Obesity
- Alcohol abuse
- Sedentary lifestyle

Symptoms

- **Chest pain** – most typical anginal symptom. Its features include:
 - Discomfort of dull pressure or burning, during ACSs maybe crushing, squeezing or vicelike.
 - Usually retrosternal, may be radiating to neck, jaws, epigastrium, shoulders or arms
 - Onset on exertion or emotional stress, resolving at rest nonpalpational, nonpositional and nonpleuritic
 - Lasting for several minutes,
 - Resolves with nitroglycerin intake



Common precipitating factors of agina

- meal
- exertion
- cold wind
- emotional stress

Typical anginal pain localization



Anginal equivalents („masks“)

- Dyspnea and fatigue (more often in the elderly)
- Syncope and presyncope (more often in the elderly)
- Nausea and vomiting (more often in ischemia of the inferior wall of the heart)

Canadian Society of Cardiology Classification (CCS)

Class	Activity Evoking Angina	Limits to Physical Activity
I	Prolonged exertion	None
II	Walking > 2 blocks or > 1 flight of stairs	Slight
III	Walking < 2 blocks or < 1 flight of stairs	Marked
IV	Minimal or at rest	Severe

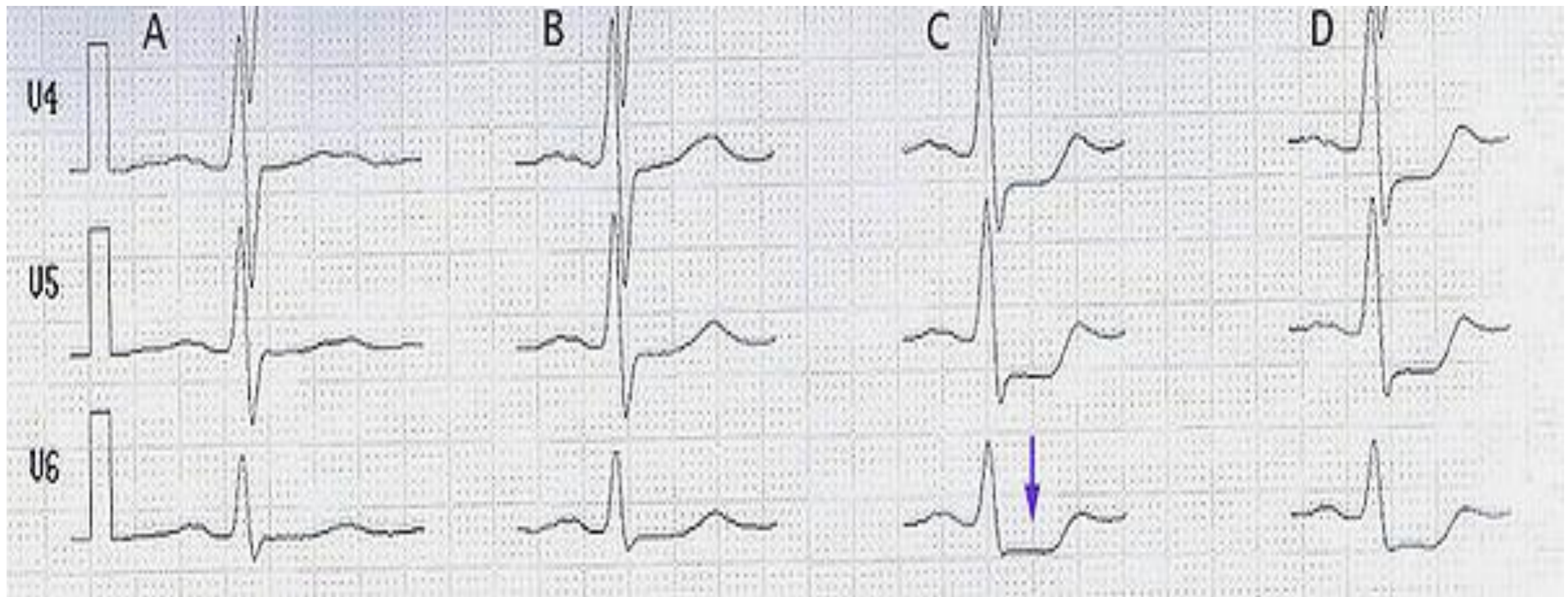
Symptoms and Signs

- Angina pectoris **has no specific signs.**
- Physical examination may show comorbidities, especially signs of other arteries' atherosclerosis predicting higher CAD risk.

Diagnositics

- Laboratory findings – reveal risk factors of atherosclerosis, first of all dislipidemia and glucose metabolism disorders
- ECG – performed during angina in 50% of cases shows features of myocardial ischaemia (mainly ST segment depression).

Typical ST depression showing myocardial ischemia



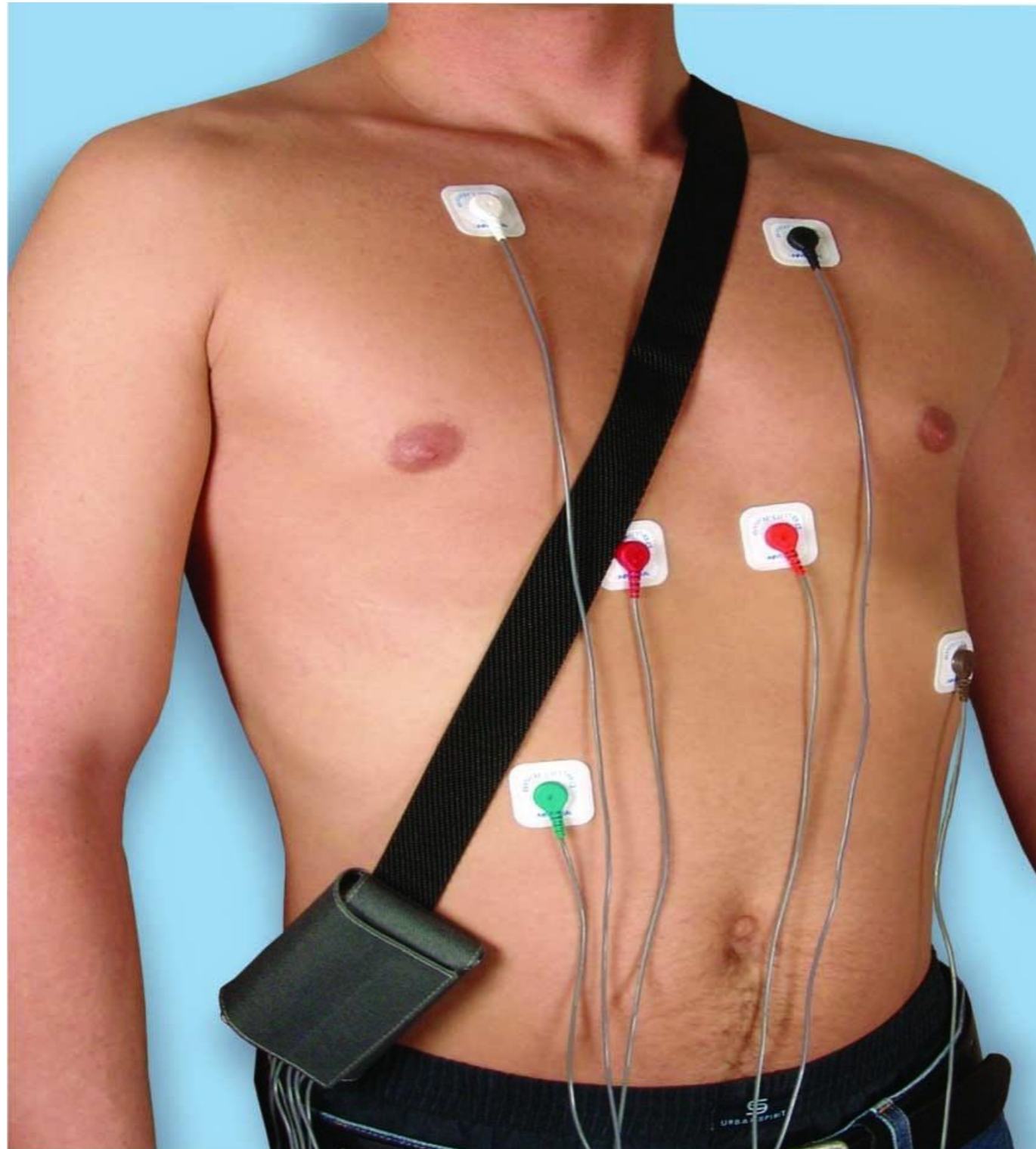
Diagnosics

- Exercise stress test (EST)- basic method in stable angina diagnosis
- Holter monitor – ambulatory electrocardiography device – reveals rhythm disorders and silent ischemia.

Treadmill EST



Holter monitor



Diagnostics

- 5. Echocardiography – may reveal other diseases causing anginal pain (for example: aortic stenosis, hypertrophic cardiomyopathy) and permanent wall motion disorders or left ventricular ejection fraction depression after myocardial infarction.

Echocardiography



Diagnosics

- Imaging stress tests: echocardiographic and scyntigraphic
 - Assessment of segmental wall motion disorders (echocardiographic test) or perusion defects (scyntigraphic test) caused by ischemia induced by exertion or pharmacologic stress.

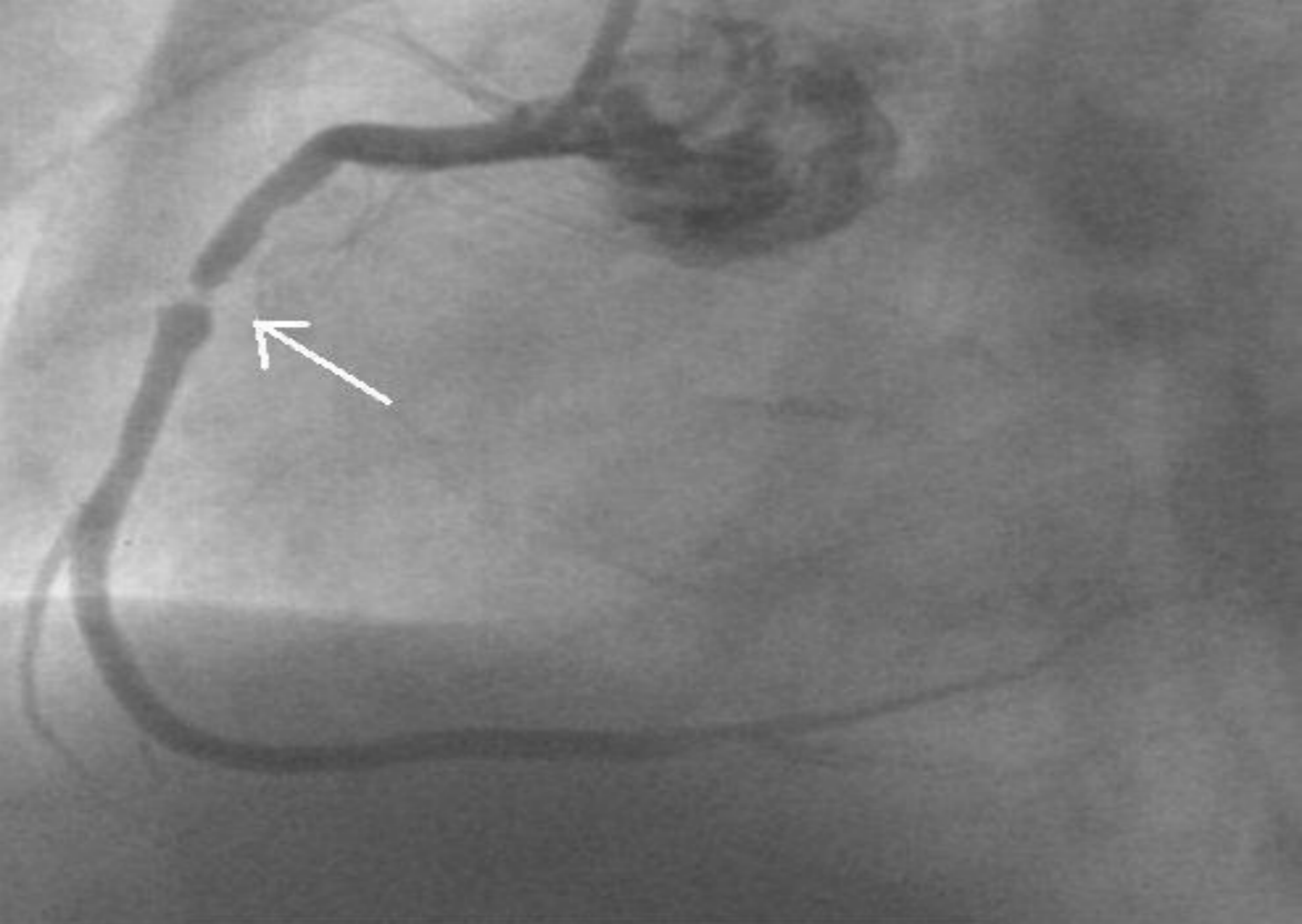
Diagnostics

- 7. Coronary angiography – imaging of coronary arteries or coronary aortic bypass grafts by means of X-ray during selective percutaneous coronary artery contrast infusion

Coronary angiography

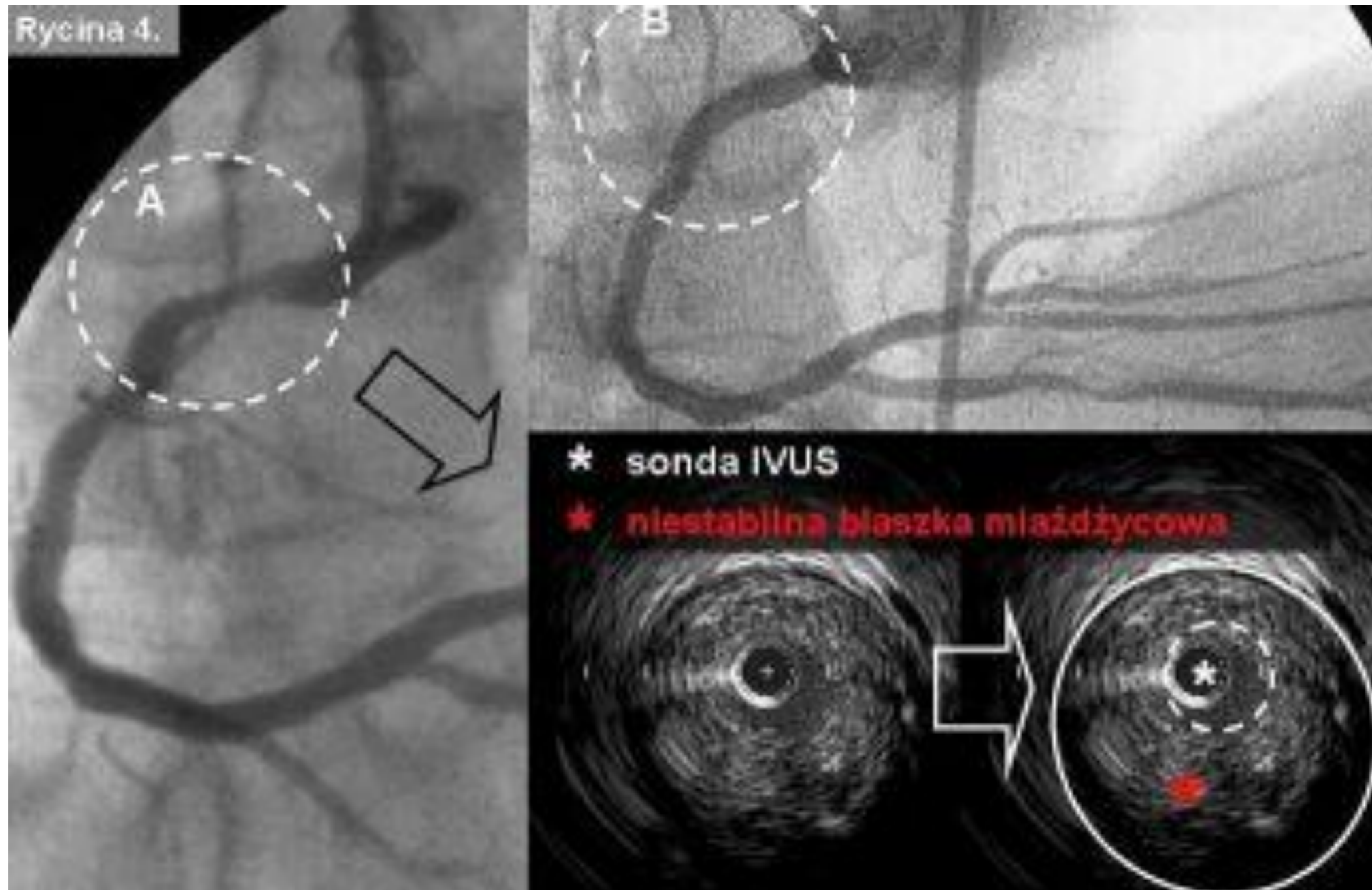






Coronary Angiogram of the RCA showing a significant stenosis of the Mid-RCA

Coronary angiography



Treatment

- Aims:
 - Pain alleviation – by diminishing ischemia and preventing its recurrence
 - Prevention of cardiovascular events and life prolonging

Treatment includes:

- Fighting risk factors:
 - smoking
 - obesity
 - dyslipidemia
 - Impaired glucose tolerance and diabetes
 - Arterial hypertension

Treatment

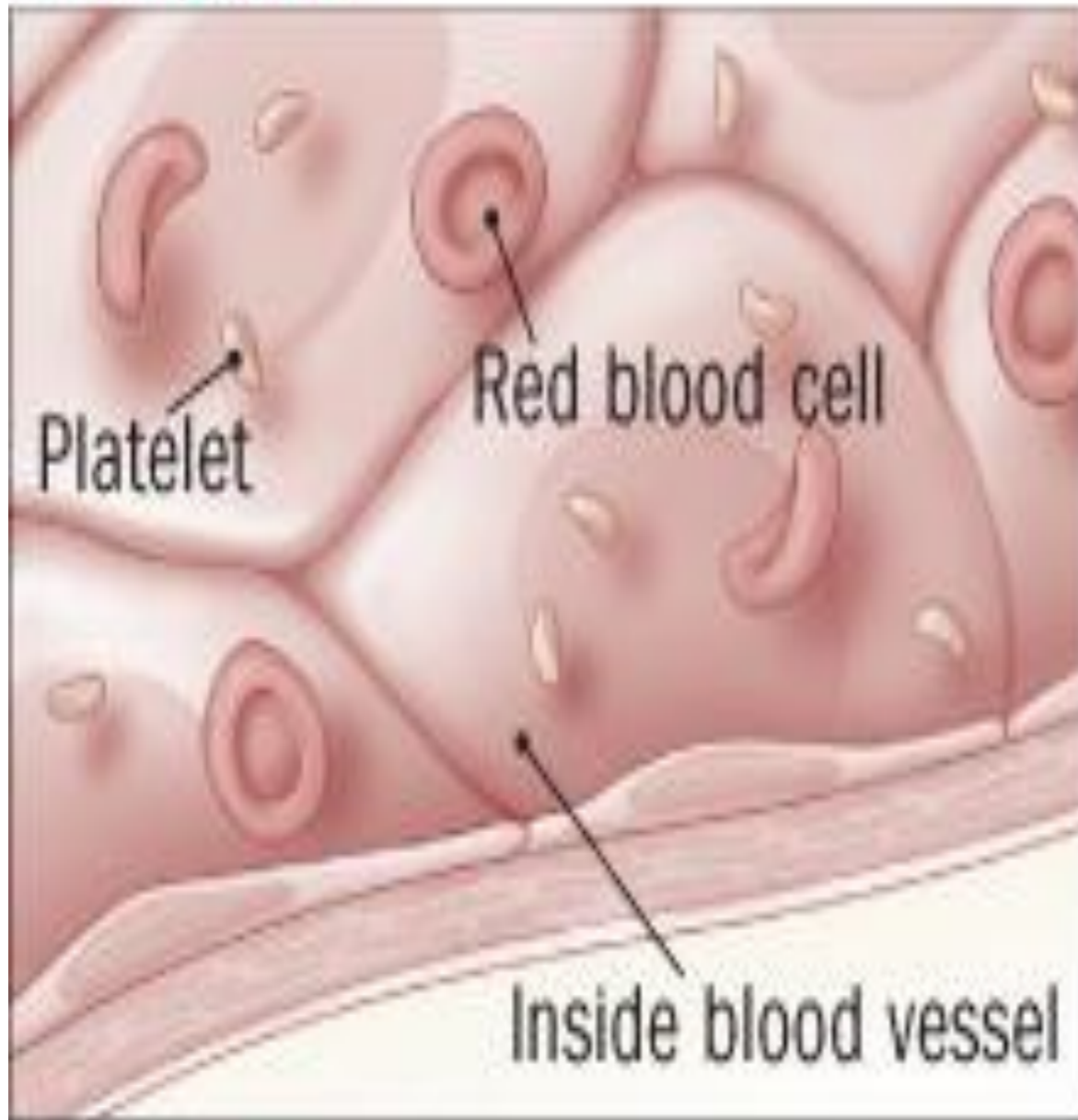
- treatment of comorbidities such as anaemia and hyperthyroidism
- antiplatelet therapy preventing thrombotic events
- anti-ischemic treatment

Medical management preventing cardiovascular events and death

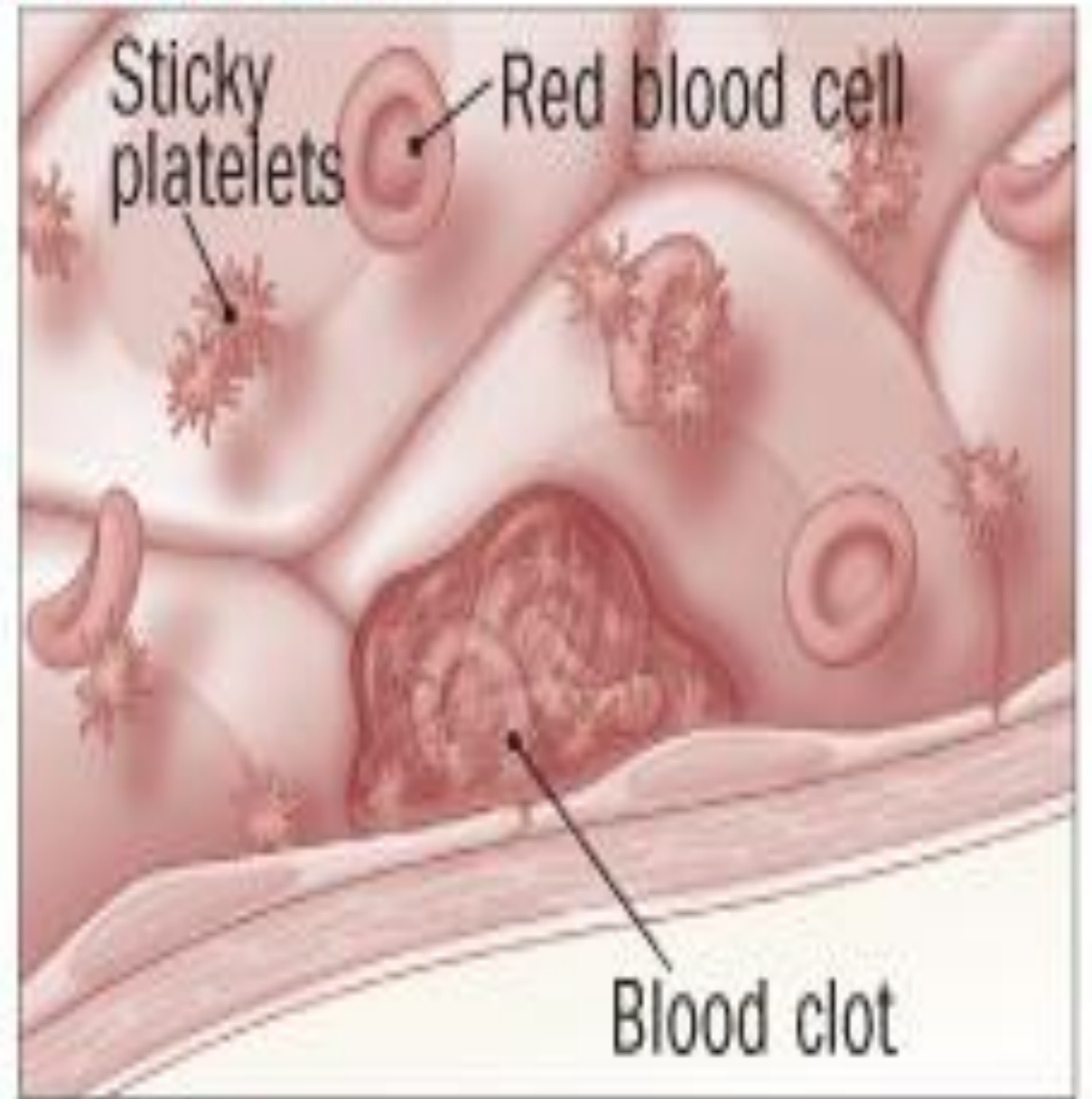
- 1. Antiplatelet drugs
 - Aspirin
 - Adenosine diphosphate (ADP) receptor inhibitors
 - Clopidogrel, prasugrel, ticagrelor
 - Ticlopidine
- 2. Statins
- 3. ACE-inhibitors

Aspirin anti-aggregation effect

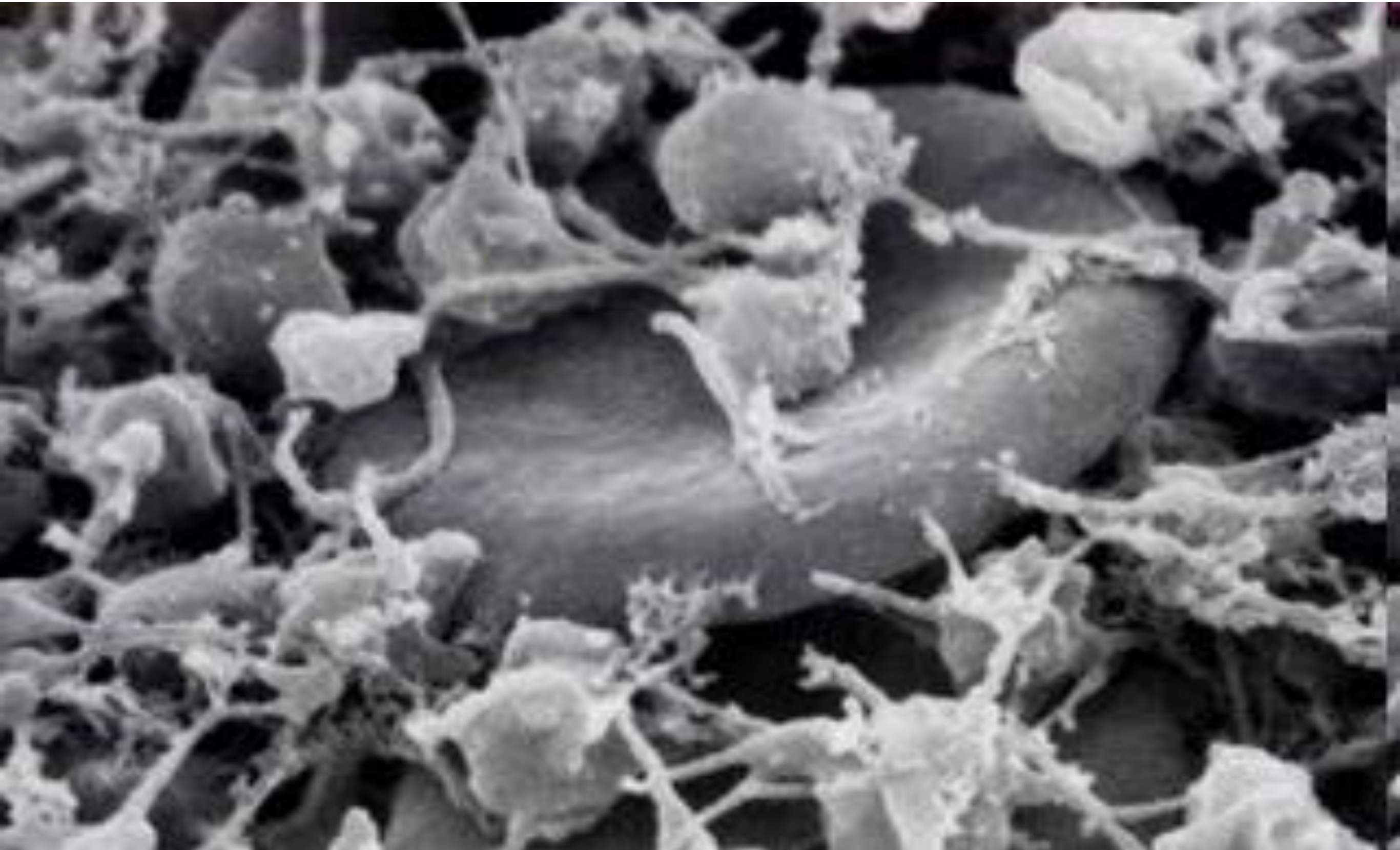
With aspirin



Without aspirin



Activated platelets



Anti-ischemic treatment

- β -blockers
 - Agents of first choice in stable angina
 - Improve exercise tolerance, decrease intensiveness and frequency of anginal pain
 - Prolong life in patients after myocardial infarction

Anti-ischemic treatment

- Calcium channel blockers
 - Cause dilatation of epicardiac arteries and arterioles and consequently increase coronary blood flow
 - Decrease myocardial oxygen demand mainly by decrease in systemic vascular resistance and lowering arterial blood pressure
 - Administered instead of betablockers (in case of contraindications) or in combination when treatment with betablockers is insufficient

Anti-ischemic treatment

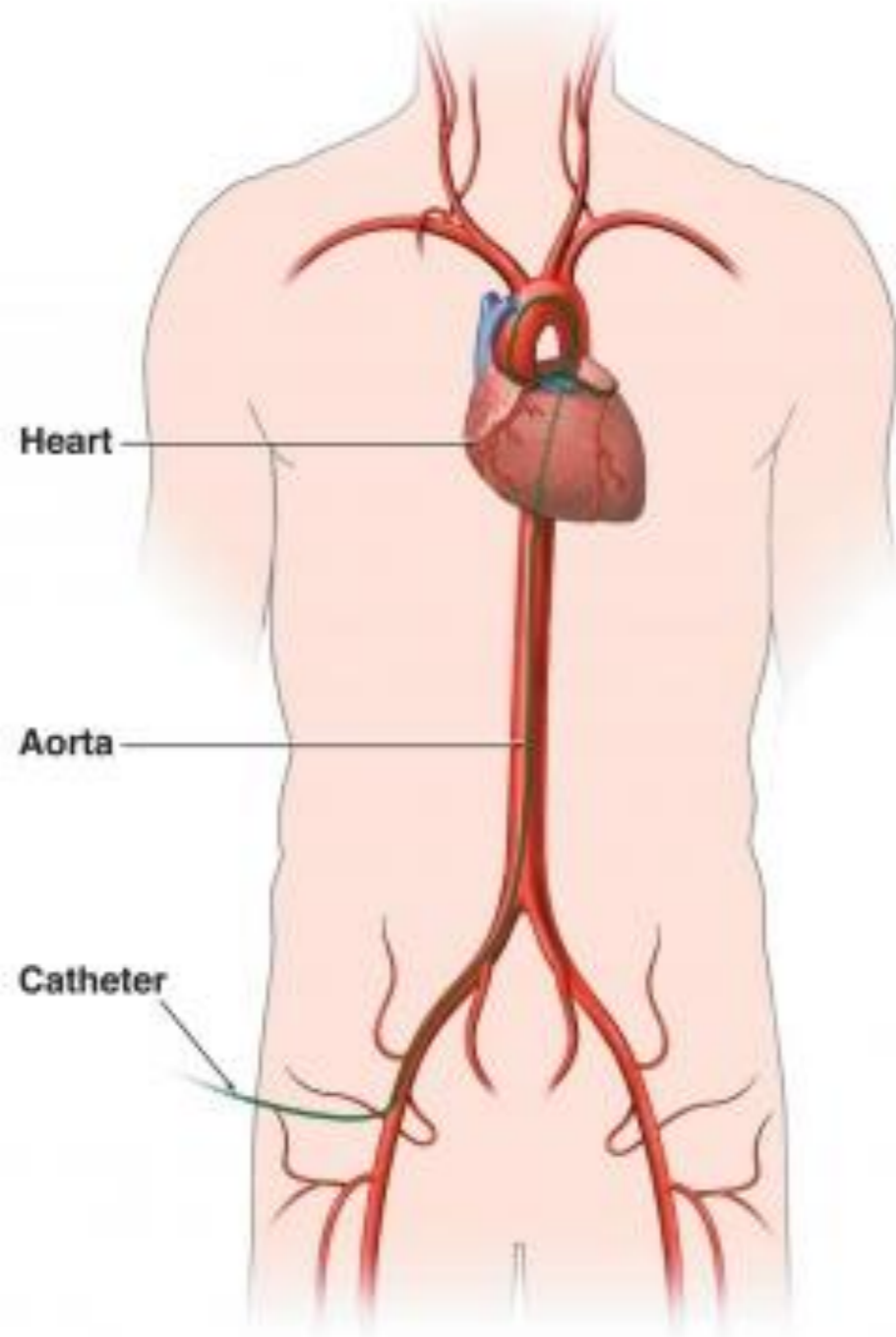
- Nitrates
 - Cause decrease in oxygen consumption by myocardium, decrease of preload and afterload and dilation of epicardial arteries and smaller branches
- Other drugs
 - molsidomine
 - trimetazidine

Interventional cardiology

Percutaneous transluminal coronary angioplasty (PTCA)

- dilatation of stenotic coronary artery by means of inflation of the balloon introduced through percutaneous catheter in order to regain myocardial perfusion
- in most cases stents are implanted into the lumen of the vessel to keep it open

Percutaneous transluminal coronary angioplasty (PTCA)



Cut-away view of circumflex artery



A. The lumen of the circumflex artery has 90% blockage.



B. A balloon catheter is inserted into the restricted lumen.

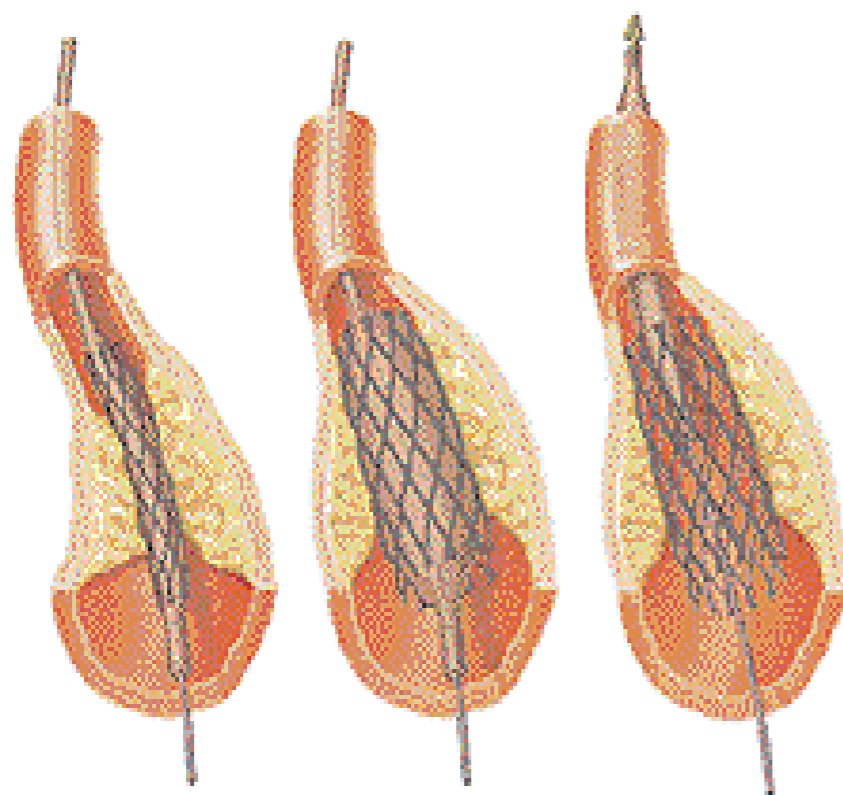


C. The balloon is inflated, which pushes out against the plaque lumen.



D. The balloon is withdrawn, leaving a large passageway through the lumen.

Implantation of stent into coronary arteries



Stent na niewypelnionym balonie

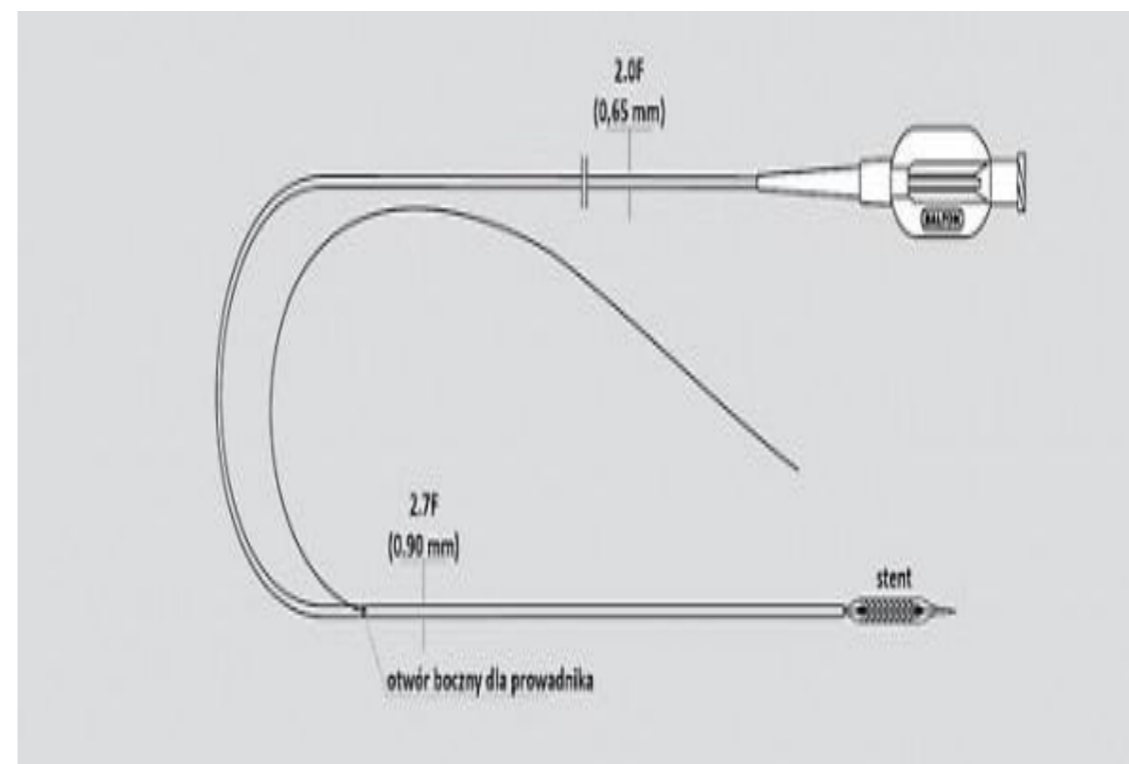
Wypelniony balon rozpręta stent

Usunięcie balonu z pozostawieniem stentu w miejscu zwężenia

stent on balloon

balloon inflation

stent placed in stenotic artery

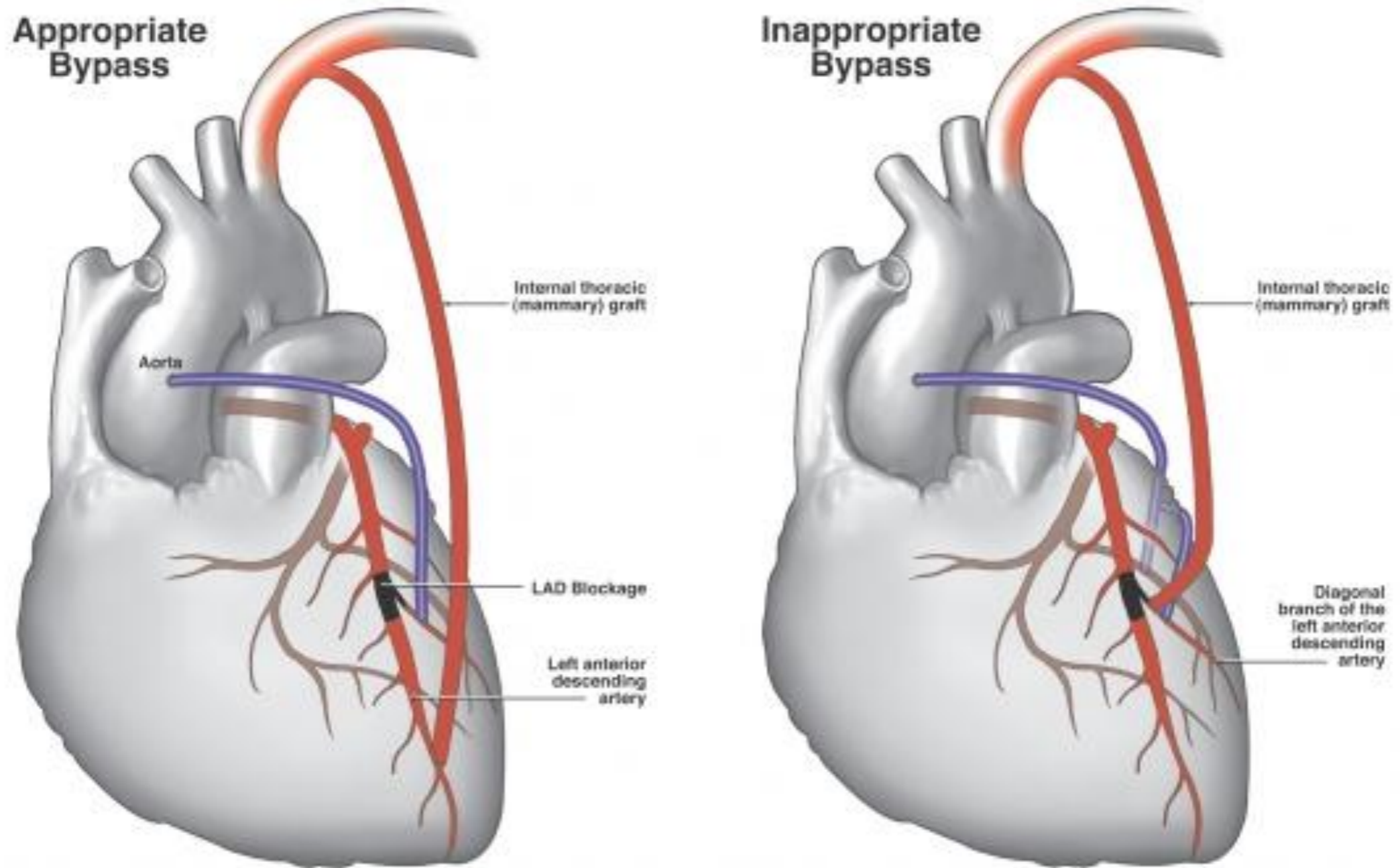


Cardiosurgery

Coronary artery bypass graft (CABG)

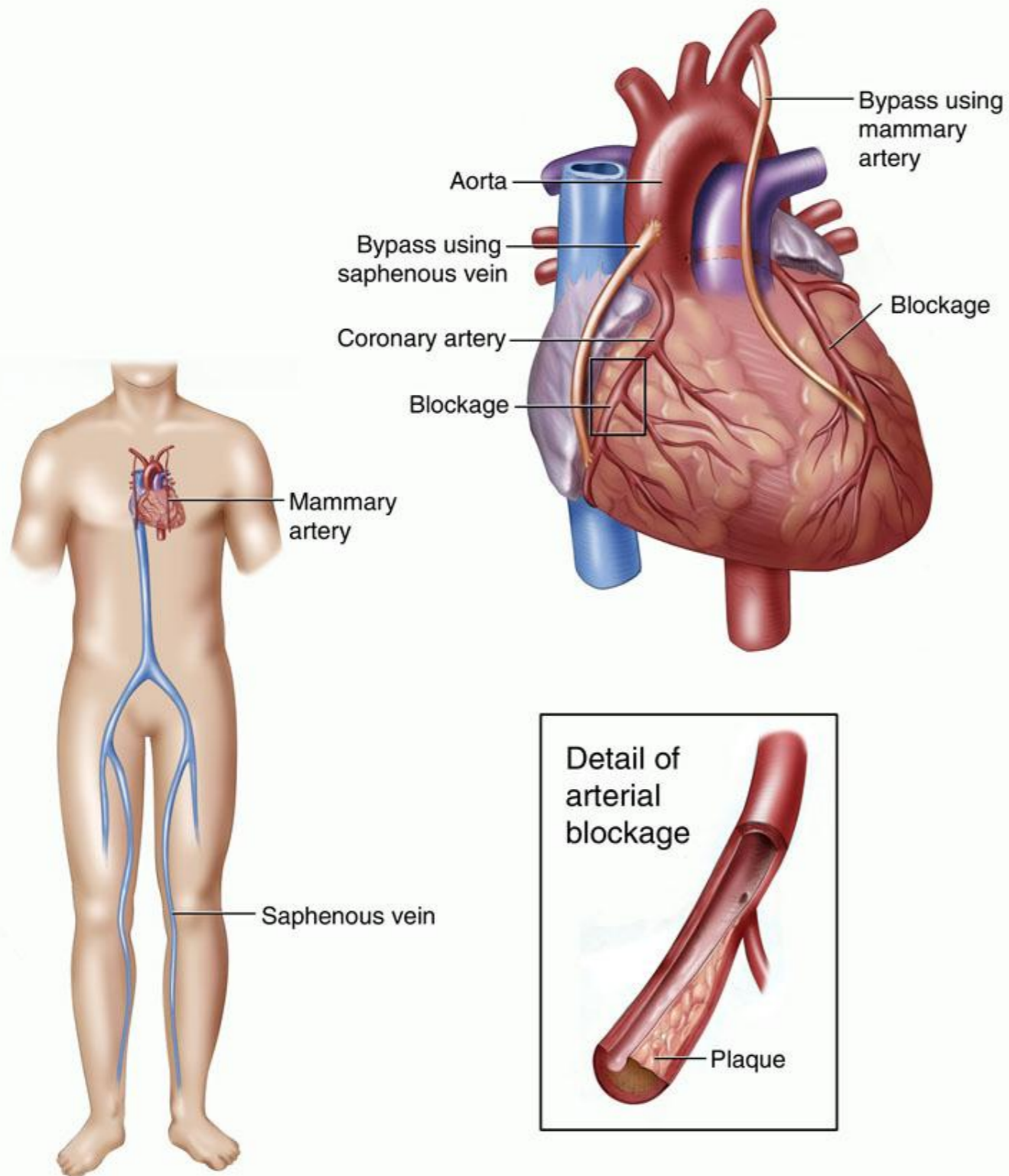
- artificial connection between aorta and coronary arteries, bridging over stenosis to improve perfusion in ischemic myocardium
- graft may be made of great saphenous vein, internal thoracic artery or rarely of cephalic or small saphenous vein.

Coronary artery bypass graft (CABG)

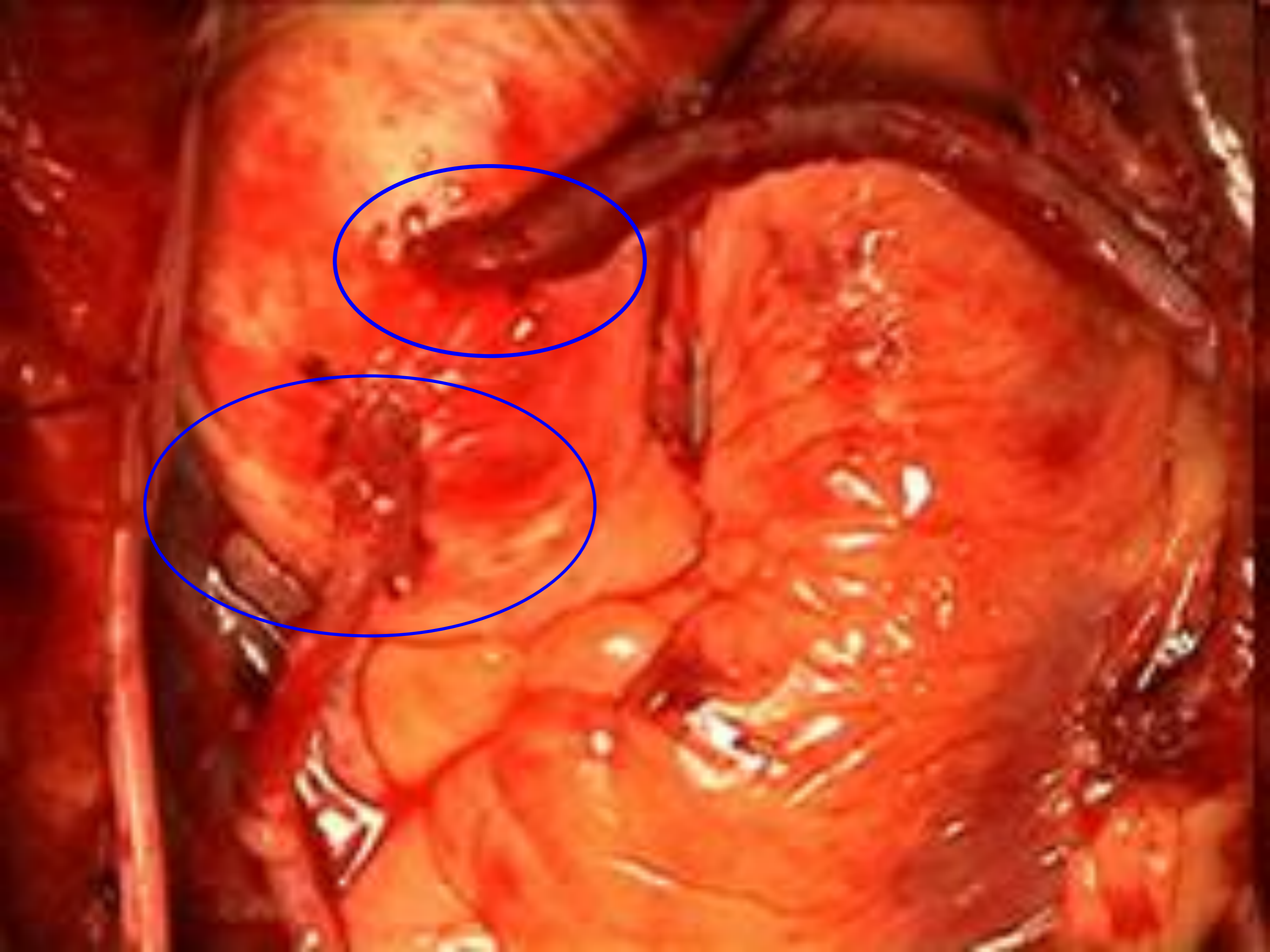


Anterior views of the heart

Coronary Artery Bypass Surgery



Coronary artery bypass graft (CABG)



Variant angina

- IHD in which symptoms are a result of vasospasm (most often in RCA)
- ECG manifestation: Transient ST segment elevation
- Angina episodes usually fade away and do not result in myocardial infarction

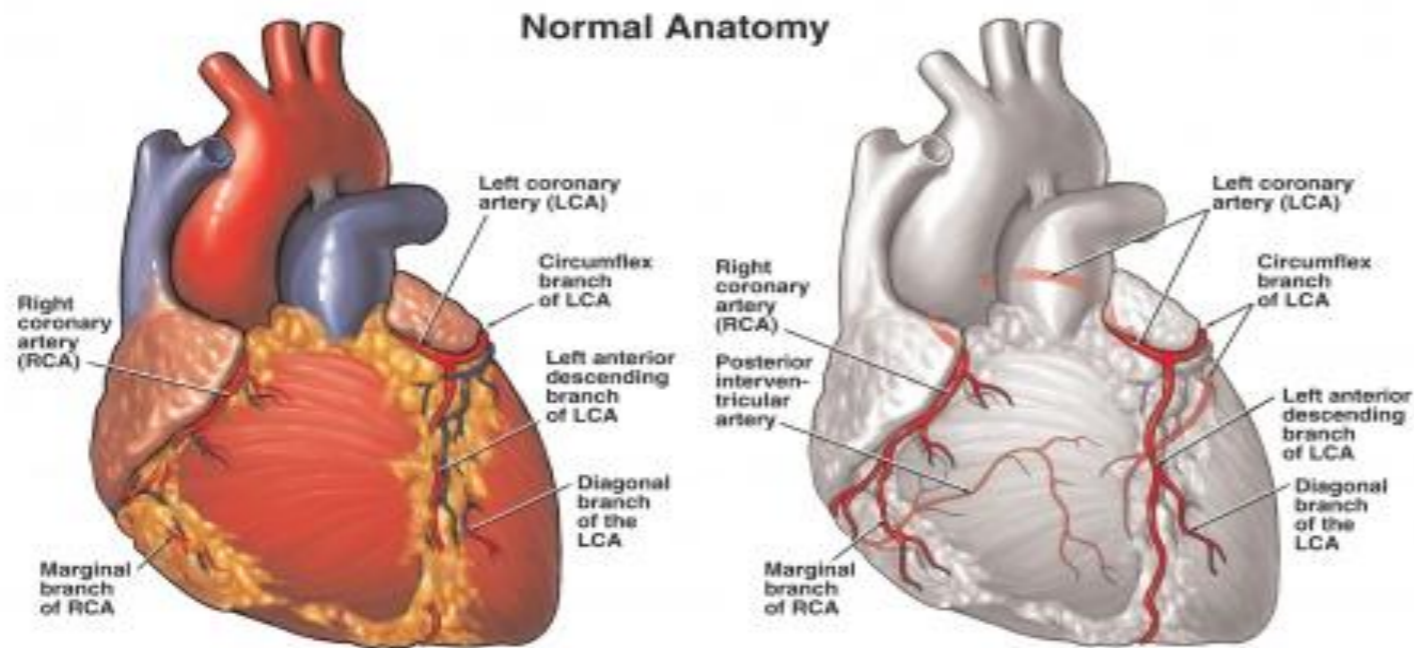
Cardiac syndrome X

- Syndrome consists of 3 characteristic features:
 - Anginal pain
 - ST segment depression on EST
 - Normal coronary angiogram

Cardiac syndrome X prevails in women in postmenopause women

Myocardial bridge

- Myocardial bridge – a band of myocardium over epicardial artery leading to narrowing of the vessel's lumen only during systole
- Presentation: Angina induced by exertion



Myocardial bridge

