Coronary Circulation
Coronary Heart Disease

Assoc. Prof. MUDr. Markéta Bébarová, Ph.D.

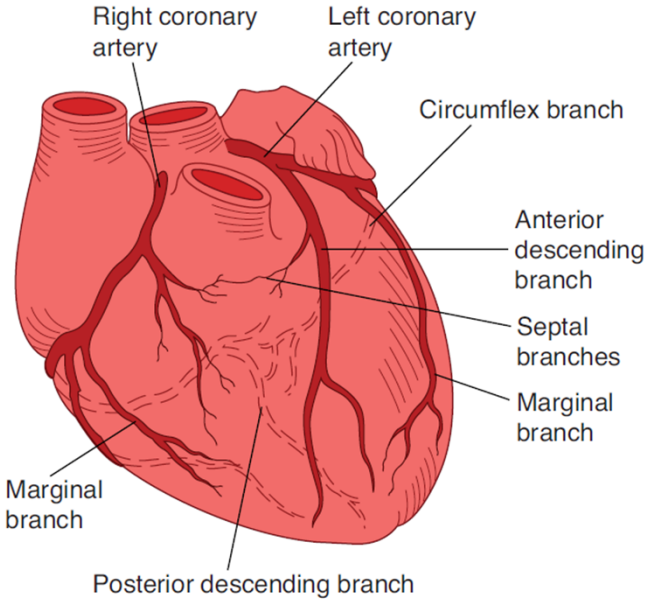
Department of Physiology, Faculty of Medicine, Masaryk University

This presentation includes only the most important terms and facts. Its content by itself is not a sufficient source of information required to pass the Physiology exam.

Coronary Circulation

- *a. cor. sinistra*
- *a. cor. dextra*

- O_2 diffusion directly from the blood situated in the cardiac cavities
- placing of coronary arteries and capillaries in the cardiac walls; consequences!



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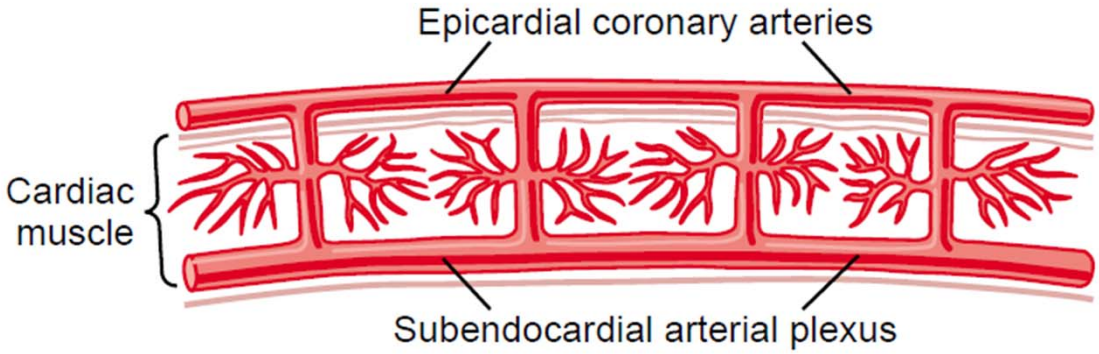

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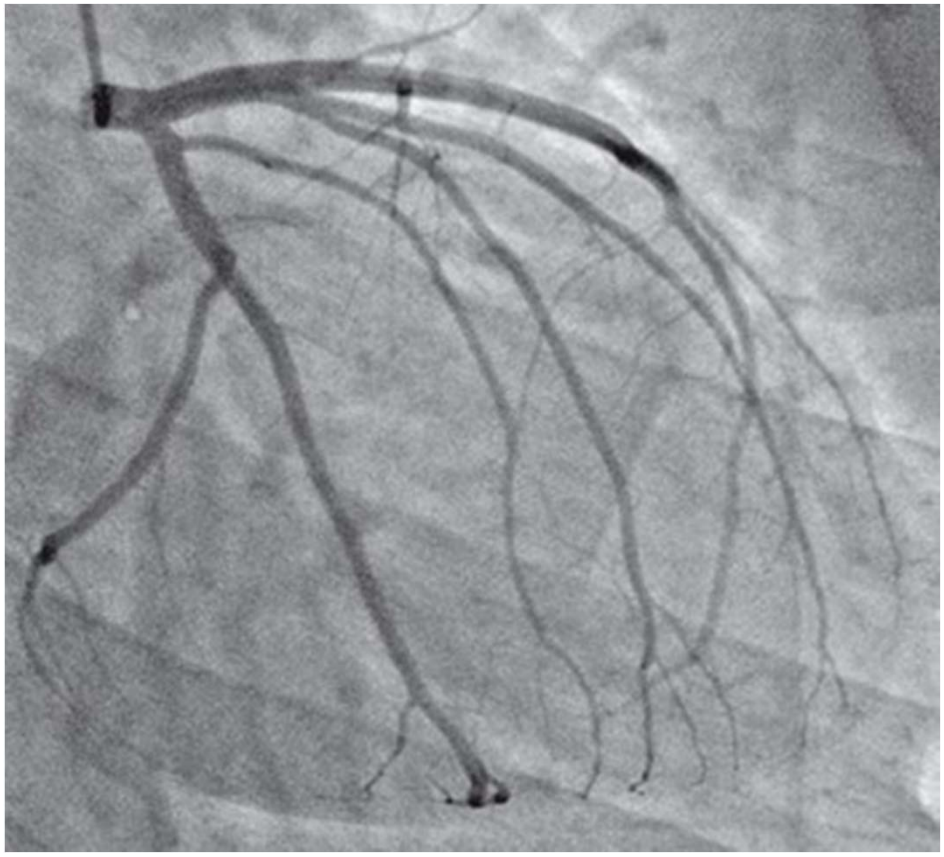
Coronary Circulation

Coronary angiography



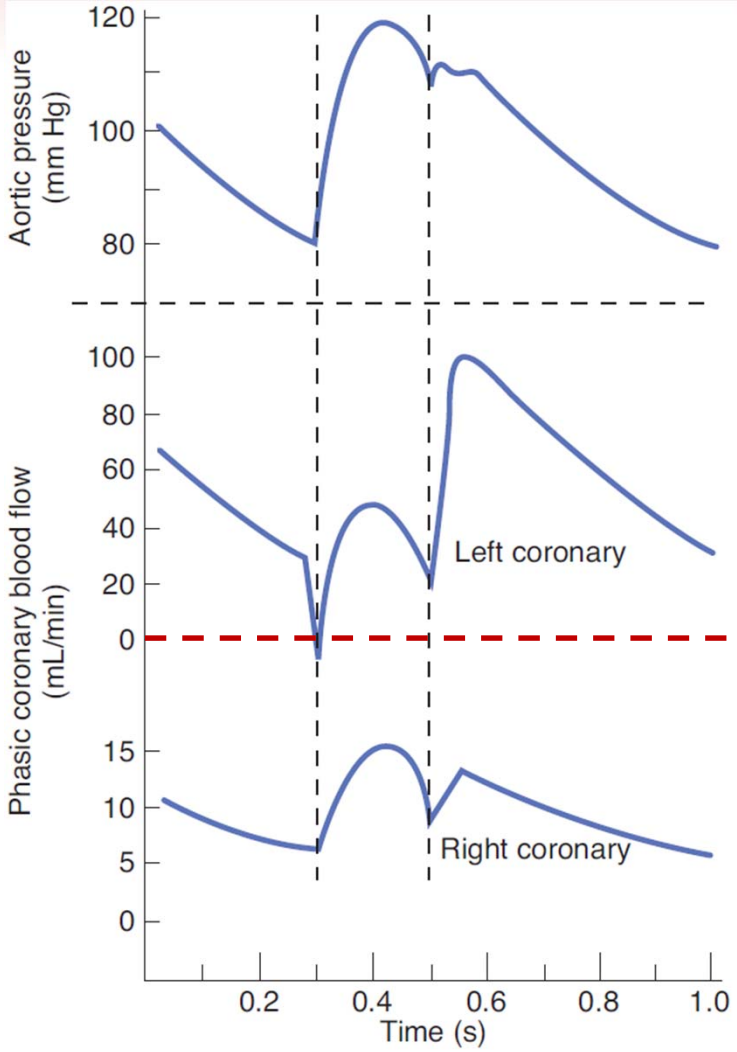
http://pochp.mp.pl/aktualnosci/show.html?id=55102

Coronary Circulation

TABLE 34–4 Pressure in aorta and left and right ventricles (vent) in systole and diastole.

	Pressure (mm Hg) in			Pressure Differential (mm Hg) between Aorta and	
	Aorta	Left Vent	Right Vent	Left Vent	Right Vent
Systole	120	121	25	–1	95
Diastole	80	0	0	80	80

- intramural vessels
- left *vs.* right ventricle
- high heart rate



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Coronary Circulation

- O_2 extraction is almost maximal already at rest, capillaries are open

↓

- The only possibility how to increase O_2 supply (for example during exercise) is the coronary vasodilation!

Coronary Circulation

Control of coronary blood flow

1) reduction/interruption of the blood flow or increased demands

↓

hyperaemia (reactive or active) based on the metabolic vasodilation

Coronary Circulation

Control of coronary blood flow

2) the neural regulation of the vessel diameter – secondary impact
   a) indirect effects
   b) direct effects

X (mostly opposite)

Coronary Circulation

Control of coronary blood flow

2) the neural regulation of the vessel diameter – secondary impact

   a) indirect effects

      sympathetic system (NE, E)

      ↑ HR + contractility → rate of cardiac metabolism → increased O_2 consumption → activation of local vasodilating mechanisms

      parasympathetic system (ACH)

      opposite changes → vasoconstriction

Coronary Circulation

Control of coronary blood flow

2) the neural regulation of the vessel diameter – secondary impact
   a) indirect effects
   b) direct effects

vasospastic myocardial ischemia

sympathetic system (NE, E)

epicardial vessels – mostly α-rec. → vasoconstriction
intramural vessels – mostly β-rec. → vasodilation

parasympathetic system (ACH)

vasodilation, but not significant (only few fibers)

Coronary Circulation

Control of coronary blood flow

2) the neural regulation of the vessel diameter – secondary impact
   a) indirect effects
   b) direct effects

Whenever the direct effects alter the coronary blood flow in the wrong direction, the metabolic control overrides them within seconds!

Coronary Reserve

- ability of coronary vessels to adapt blood flow to the actual cardiac work (**ergometry**)
- **the maximal blood flow / the resting blood flow**
- reduction of the coronary reserve:
  - relative coronary insufficiency
  - absolute coronary insufficiency (~ coronary heart disease)

Reduced coronary reserve is a limiting factor of the cardiac output, thus, also of the effort of organism!

Coronary Heart Disease

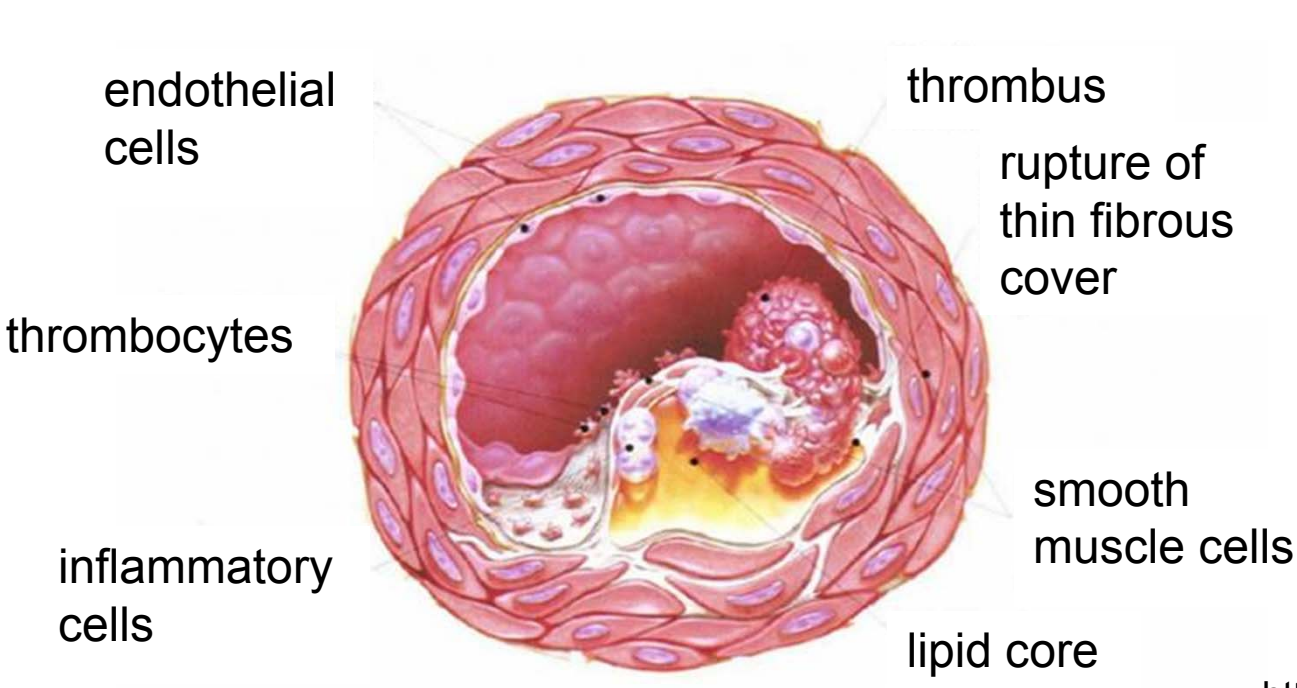
= ischemic heart disease, coronary artery disease

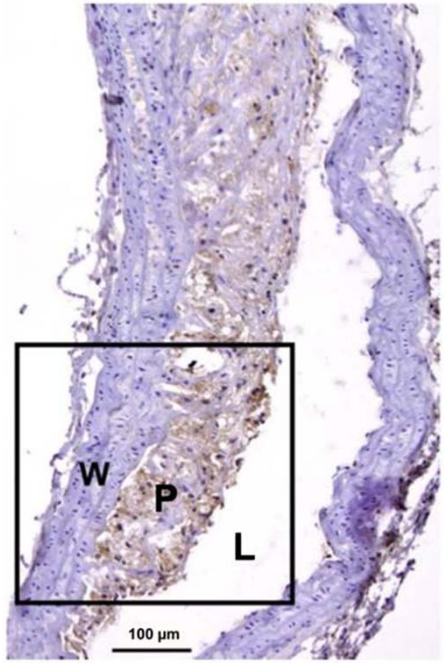
- the most often cardiac disease in Western culture
- about 1/3 of all deaths

- *vs.* myocardial ischemia

Coronary Heart Disease

- pathogenesis: atherosclerotic process of one or more branches of the coronary circulation





http://www.thno.org/v03p0894.htm

http://int2.lf1.cuni.cz/pruvodce-pro-pacienty-pred-katetrizacnim-vysetrenim-srdce

Coronary Heart Disease

- symptoms:
  - pain behind the sternum (*angina pectoris*)
  - changes of ST segment and T wave on ECG ; character of the changes

Symptoms are usually provoked by physical exertion, cold, rapid increase of the blood pressure, etc.

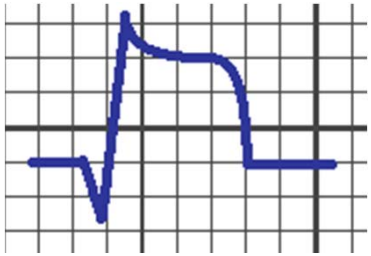
Coronary Heart Disease

- **Myocardial infarction**

  = sudden closure of a coronary branch, usually by a thrombus originating on the strength of a rupture of the atherosclerotic plate, changes are irreversible

  - <u>symptoms</u>:
    - severe unremitting pain behind sternum
    - heart failure (in the case of a bigger extent)
    - on ECG: ST elevation followed by T wave without any decrease to the isoelectric line (the Pardee´s sign)

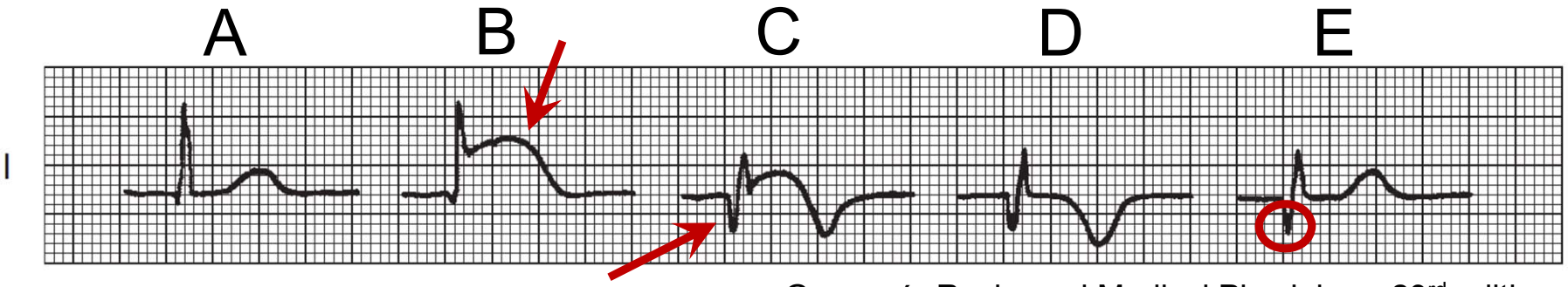
  - healing by a scar
    (deep Q wave)



http://www.wikiskripta.eu/index.php/Popis_EKG

Coronary Heart Disease

- **Myocardial infarction**



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A. Physiological tracing in lead I
B. Myocardial infarction – acute phase – hours from infarction.
C. Many hours till days from infarction.
D. Late pattern - many days till weeks from infarction.
E. Very late pattern – months till years from infarction.

Coronary Heart Disease

The degree of damage of the heart muscle is determined to a great extent by the degree of collateral circulation!

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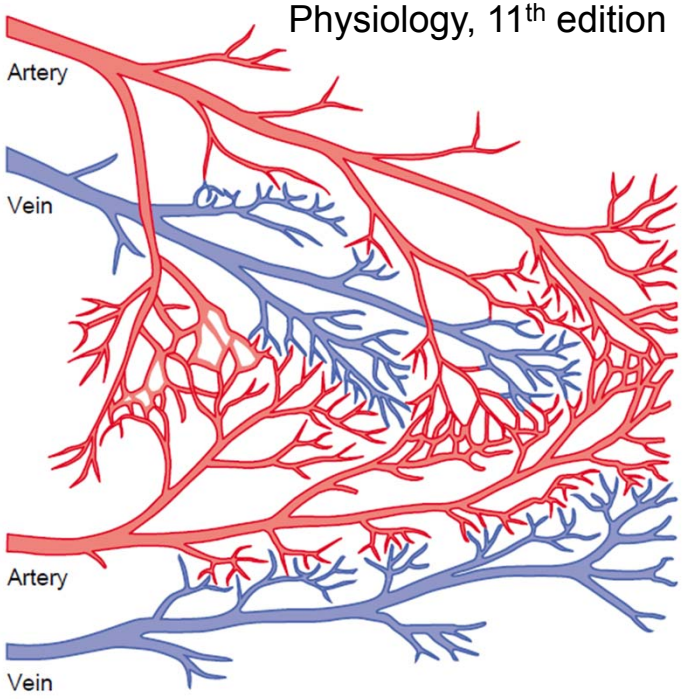
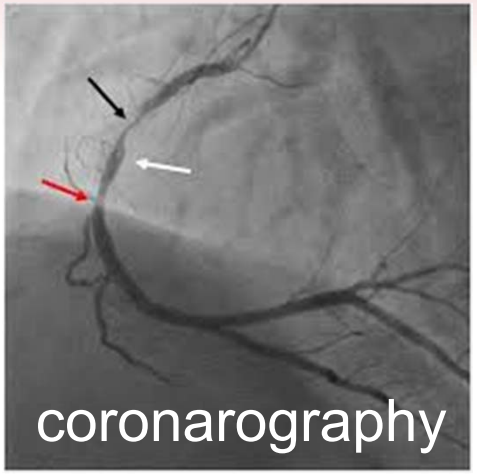


Coronary Heart Disease

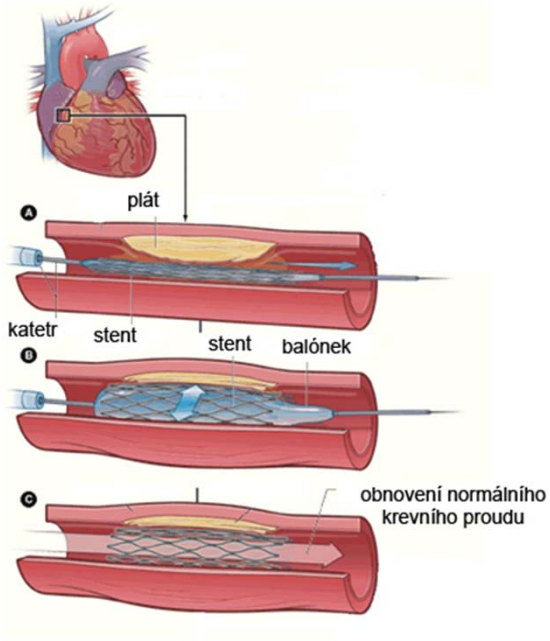
- **Treatment with drugs**
  - Vasodilatory drugs
  - Beta-blockers

Coronary Heart Disease

- **Surgical treatment**

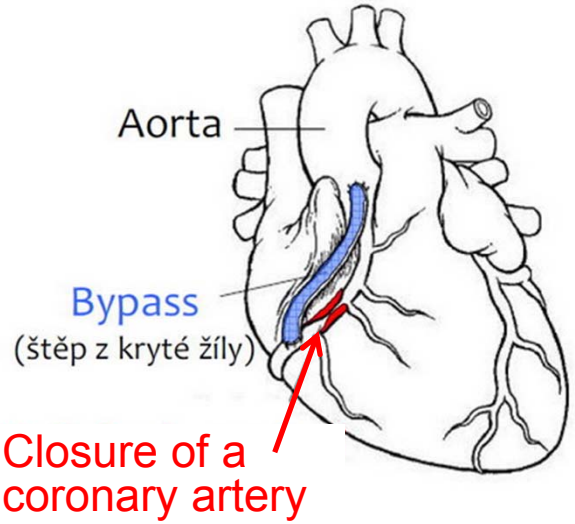


Coronary Angioplasty



http://www.ikem.cz/www?docid=1005912

Aortic-Coronary Bypass



http://www.sedmstatecnych.cz/clanek/opravene-srdce-po-trech-letech/