CIRCULATORY FAILURE

- The main function of circulation is keep a good organ and tissue perfusion

BP = CO x TPR

Circulatory failure is a generalized inadequate blood flow in the body that causes tissue damage due to reduced blood flow - reduced transport of oxygen (and other nutritional factors). The cardiovascular system itself (cardiac muscle, vascular walls, vasomotor system, and other parts of circulation) worsens when coming „circulatory shock“

CIRCULATORY FAILURE

$$BP = CO \times TPR$$

CO decrease:

- ✓ ***lower volume in circulation*** **– lower venous return**

decrease of filling pressure and by Frank-Starling principle decrease of CO

Clinical: e.g. hemorrhagic shock, hypovolemic shock

Therapy: infusion (e.g. of physiological solution)

CIRCULATORY FAILURE

$$BP = CO \times TPR$$

CO decrease:

- ✓ ***vasodilatation of venous system*** **- sudden periphery vasodilatation – e.g. sudden loss of vasomotor tone : vasomotor syncope (neurogenic shock-brain damage, deep anesthesia)**
- ✓ **emotional activation of parasympathetic signals to slow the heart and also activation of inverse sympathetic signals to dilate the peripheral vasculature : vasovagal syncope (emotional disturbance-fainting in young people)**

CIRCULATORY FAILURE

BP = CO x TPR

CO decrease:

✓ ***lower pumping*** **function of the heart**

e.g. myocardial infarction, severe dysfunction of the heart valves, cardiac arrhythmias

Result: cardiogenic shock

= circulatory shock, which results from the weakened ability of the heart as a pump; (85% of people who develop a cardiogenic shock will not survive)

CIRCULATORY FAILURE

BP = CO x TPR

Circulatory shock without the change of CO

Abnormal increase in metabolic demands of the organism (so great that physiological CO is insufficient)

Abnormal tissue perfusion – e.g. septic shock (blood poisoning)

(inadequate supply of nutrients or inadequate production of waste substances from tissues)

CIRCULATORY FAILURE

$$BP = CO \times TPR$$

TPR decrease:

- ✓ **toxic vasodilatation (by histamin-allergy) – anaphylactic shock** - sting by a bee

- ✓ **Dysbalance of autonomy nervous system – sympathetic part – decrease of sympathetic tone of vessels** vegetative collapse - dysbalance of the autonomic nervous system (decrease in the influence of sympathetic to the vascular tone – everything is related to the situations described in vasodilation of the venous system)

NYHA classification

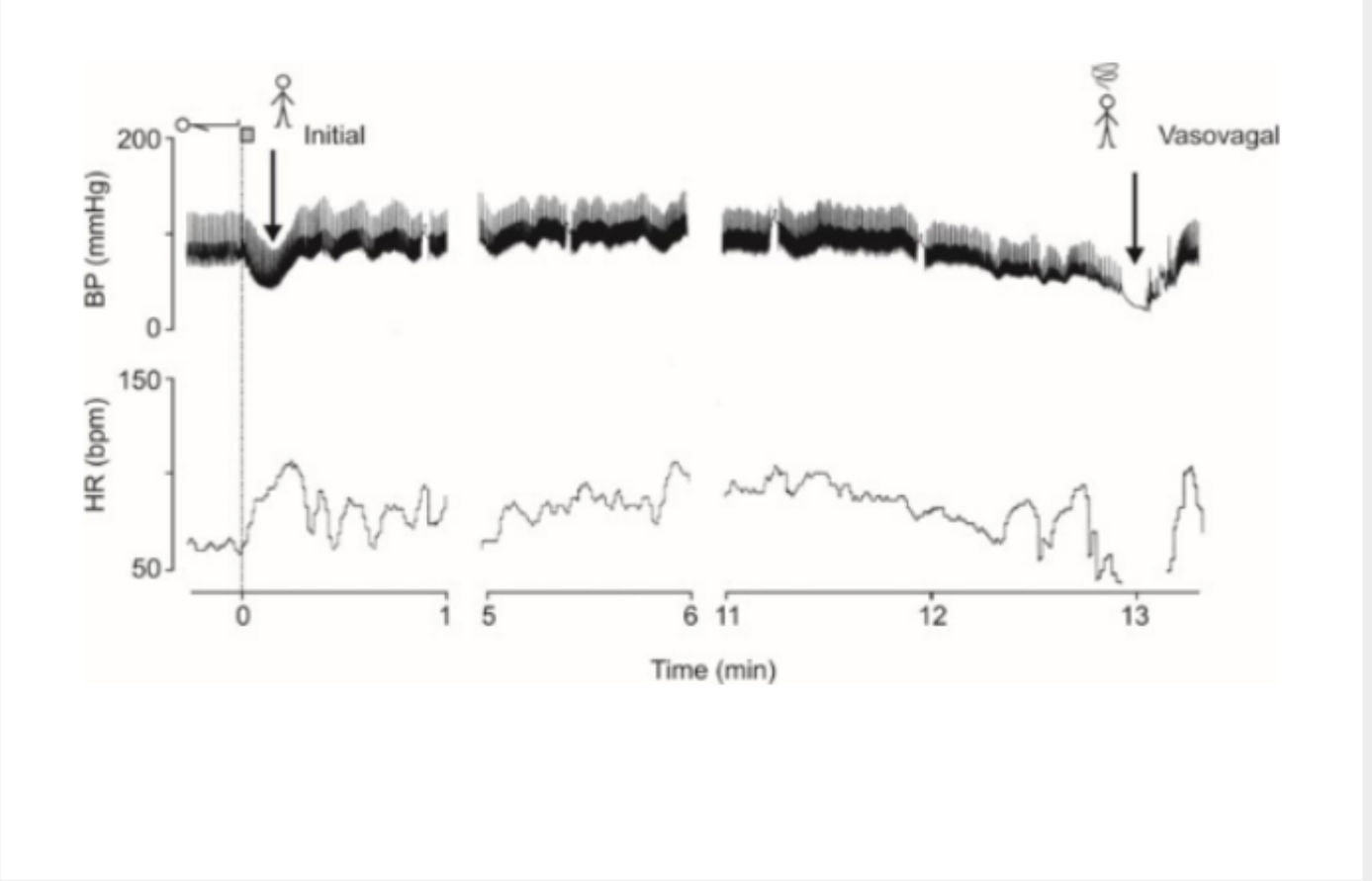
Functional Capacity	Objective Assessment
Class I	Patients with cardiac disease but without resulting limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitations, dyspnea, or anginal pain.
Class II	Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or anginal pain.
Class III	Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea, or anginal pain.
Class IV	Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of heart failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.

Source: Adapted from New York Heart Association, Inc., *Diseases of the Heart and Blood Vessels: Nomenclature and Criteria for Diagnosis,* 6th ed. Boston, Little Brown, 1964, p. 114.

- SYNCOPE - a manifestation of brain ischemia that arises with a sudden drop in blood pressure due to failure in circulation
  - if the lying - consciousness returns quickly - within one minute
- Syncope is defined as a transient loss of consciousness due to cerebral hypoperfusion, characterized by a rapid onset, short duration, and spontaneous complete recovery

- If the pressure drops for several hours, they are metabolic changes in the ischemic organs and developing „a shock“

- **SHOCK** = is acute circulatory insufficiency syndrome with manifestations of tissue ischemia in a different areas of the body



This figure shows the usefulness of a continuous tracing of finger arterial pressure (BP) and heart rate (HR) during cardiovascular reflex testing in a patient with vasovagal syncope. Drugs administration test with the Finapres® Guided Autonomic Testing application