

## Vital Signs

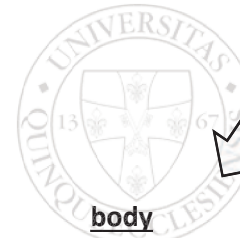
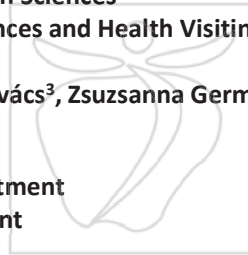
University of Pécs Faculty of Health Sciences  
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## Vital Signs

body  
temperature breathing pulse blood pressure



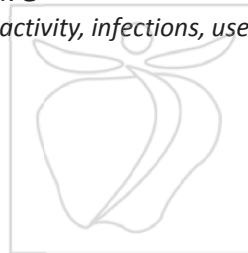
## Body temperature

- Body temperature
  - Core temperature
  - Surface temperature

- Factors affecting body temperature

*(outer temperature, metabolic activity, physical activity, infections, use of personal protectors)*

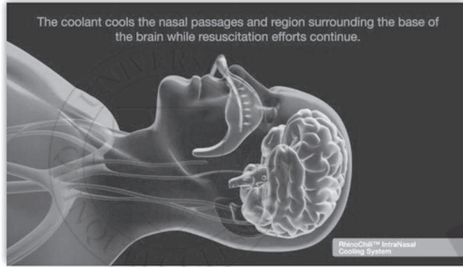
- Heat production
- Exothermis process
- Thermostatic control



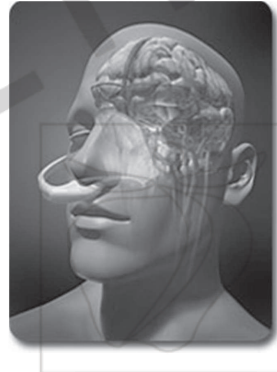
## Body temperature - Hypothermia

- Causes/Risk factors
  - homeless person, rescued from water, alcohol, antidepressants, infants, elderly
- Artificial hypothermia
- Depth levels:
  - Mild: 33 C-35 C
  - Moderate: 28 C-32 C
  - Severe: <28 C





intranasal cooling system



## Body temperature - Hypothermia

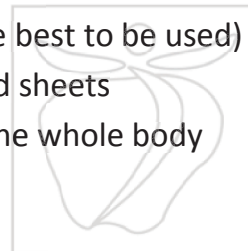
Temperature	Symptoms
36 °C	Normal temperature
35 °C	Peripheral vasoconstriction, shivering, speech disturbances, hyperreflexia
34 °C	The patient is still conscious, burdensome movements, ECG abnormalities may occur. The J-wave can be found at the meeting point of the QRS complex and ST-segment
33-31 °C	Retrograde amnesia, shivering ceases
30-28 °C	Unconsciousness, muscle rigidity, bradpnoea, bradycardia which increases, J-wave amplitude
27-25 °C	No reflexes can be induced, ventric fibrillation
17 °C	Isoelectric ECG

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## Body temperature - Hypothermia

### Treatment

- Active and passive techniques
  - Increasing the temperature of the outer environment
  - Covering the patient (wool is the best to be used)
  - Applying preheated blankets and sheets
  - These methods are applied on the whole body
  - Head should be covered

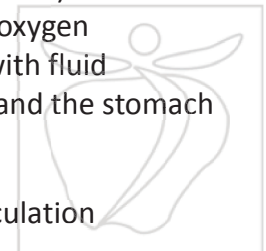


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## Body temperature - Hypothermia

### Treatment

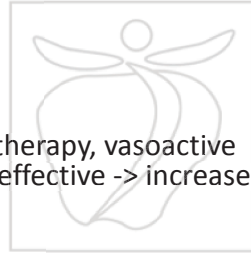
- Active and passive techniques
  - Application of liquid or air circulating heating blankets
  - Heated blankets
  - Heated infusion (heated to about 38°C)
  - Making the patient inhale heated oxygen
  - Mediastinal or peritoneal lavage with fluid
  - The lavage of the urinary bladder and the stomach with heated solutions
  - Warm water enema
  - Heating through extracorporeal circulation
  - Haemodialysis



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## Body temperature - Hypothermia

- If temperature falls below 25 C malignant arrhythmia develops
- Prevention is important
- Intensive monitoring
- Ambulance
- Temperature below 30°C defibrillation therapy, vasoactive and antiarrhythmic medications are not effective -> increase body temperature



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## Body temperature- Hyperthermia

Degrees:

- Mild: heat fatigue, heat syncope, heat exhaustion, sunstroke
- Severe: heat stroke (body temperature above 40°C)

Causes of its development

- Heat stagnation
- Increased metabolic activity
- Decreased heat dissipation



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## Body temperature- Hyperthermia

Symptoms:

- Sense of weakness
- Cool and wet skin
- Rapid weak pulse
- Dizziness
- Paleness
- Spasm in limbs
- Abdominal cramp
- Nausea
- Coordination disorders
- Sweating



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## Body temperature- Hyperthermia

- Risk groups

Treatment

- Immediate heat withdrawal
- Cooling
- Treatment of associated hypotonia
- Fluid substitution
- Prevention
- Protection from direct sunlight
- Applying ventilators or air-conditioners
- Forced fluid intake



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## Body temperature- Hyperthermia

The degrees of fever are:

- subfebrility: 37,5°C -38 °C
- febrility: 38°C -39 °C
- pyrexia: 39°C -40 °C
- hyperpyrexia: >40 °C



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## Body temperature- Hyperthermia

The causes of fever can be:

- Bacterial infection
- Viral infection
- Parasitic infection
- Fever of unknown origin
- Malignant hyperthemia:
  - potentially fatal, rapidly developing febrile condition associated with muscle stiffness, tachycardia, acidosis



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## Body temperature- Hyperthermia

Fever of Unknown Origin - FUO

- body temperature is over 38.3 C for at least 3 weeks
- cause is not detected even after a week-long medical check-up
  - nosocomial
  - neutropenic
  - HIV
  - induced by medicaments



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## Body temperature - measurement

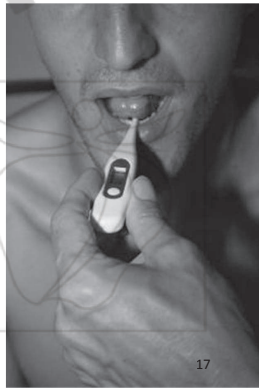
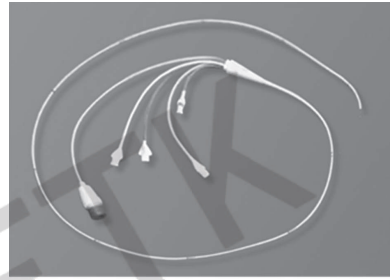
↓  
**core temperature**

- tympanic
- nasopharyngeal
- pulmonary artery
- oesophagus

↓  
**surface temperature**

- axillary
- rectal
- oral
- urinary bladder
- temporal artery



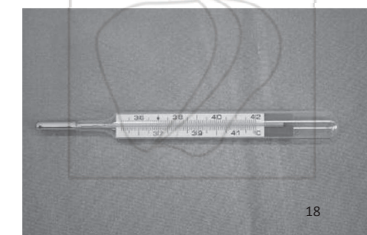
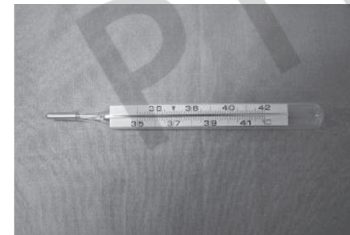


# Body temperature- Hyperthermia

## Types of thermometers

### Contact thermometers:

- Glass mercurial
- Nonmercurial glass
- Digital thermometers
- Liquid crystals
- Thermistor
- Thermocouple



# Body temperature - measurement

## Types of thermometers

### distance thermometer:

- Tympanic
- Infrared camera

### Diagnostics:

- Haemoculture



# Hyperthermia

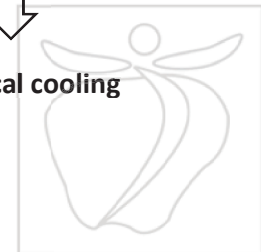
## Reduction of fever



**medicaments**  
NSAID – non-steroid anti  
inflammatory drugs



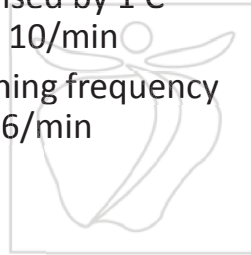
**physical cooling**



## Body temperature- Hyperthermia

### reduction of fever

- useful?
- fever loses its positive effect  $>40\text{ C}$ 
  - tissue and brain damage, multiorgan failures may develop
- the body temperature is being raised by  $1\text{ C}$  increases the heart frequency by  $10/\text{min}$
- in case of children it raises breathing frequency by  $2.5/\text{min}$ , in case of adults is  $5-6/\text{min}$
- febrile seizures
- febrile phobia



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## Body temperature- Hyperthermia

### Fever reduction:

- caring for a febrile patient
- continuous monitoring
- vital parameters
- state of skin, the degree of perspiration, temperature
- increasing oxygen provision
- fluid-ion supplementation-fluid balance
- increasing sense of comfort



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## Body temperature- Hyperthermia

### Fever reduction:

- Physical fever reduction (reducing body temperature until  $38\text{ C}$ ):
  - Sponge-down with lukewarm water
  - Cooling bath
  - Water compress (full-body, partial)
- Invasive methods for reducing body temperature:
  - Stomach lavage
  - Peritoneal lavage
  - Intravascular cooling
  - Intranasal cooling



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## Physical cooling

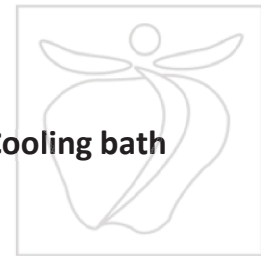




Sponge-down with lukewarm water



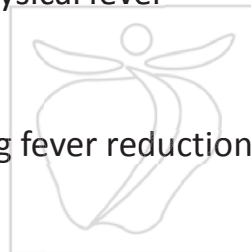
Cooling bath



## Body temperature- Hyperthermia

### Fever reduction:

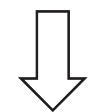
- Physical fever reduction in infant and childhood???
- Advantages, disadvantages of physical fever reduction
- Combination of physical and drug fever reduction



## Vital Signs



body temperature



breathing



pulse



blood pressure



# Blood pressure

## Factors affecting blood pressure

- Amount of blood flow
- Peripheral resistance
- Neural, reflexive and humoral regulations of the blood vessels
- Age
- Muscle work
- Body position
- Pregnancy
- Gender
- Sleeping
- Emotional state-stress



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# Daily variation of BP



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# BP in different posture



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European Society of Hypertension and European Society of Cardiology			
	Systolic pressure (Hgmm)		Diastolic pressure (Hgmm)
<b>Optimal BP</b>	<120	and	<80
<b>Normal BP</b>	120–129	and	80–84
<b>Increased-normal BP</b>	130–139	and/or	85–89
<b>I. degree hypertension</b>	140–159	and/or	90–99
<b>II. degree hypertension</b>	160–179	and/or	100–109
<b>III. degree hypertension</b>	>180	and/or	>110
<b>Isolated diastolic hypertension (IDH)</b>	<140		>89
<b>Isolated systolic hypertension (ISH)</b>	≥140		<90

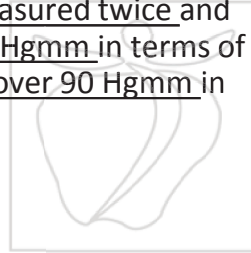
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## Blood pressure

### Hypertension:

- If the blood pressure was measured among clinical circumstances or at the GP's office, while keeping the regulations of the surroundings of the blood pressure measurements, at least three times and during each occasion the blood pressure was measured twice and their average equals or it is over 140Hgmm in terms of the systolic value and equals or it is over 90 Hgmm in terms of the dyastolic value
- 'white coat hypertension'
- 'masked' hypertension



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## Blood pressure

	Preliminary blood pressure values (Hgmm) <sup>a</sup>		Check-up, follow-up <sup>b</sup>
	Systolic	Diastolic	
Normal blood pressure	<130	<85	In 2 ys. at least
Increased normal	130–139	85–89	Yearly at least <sup>c</sup>
Hypertension I. degree	140–159	90–99	within 2 months <sup>c</sup>
II. degree	160–179	100–109	Examination, care in one month <sup>c</sup>
III. degree	180	110	Examination, care in one week <sup>c</sup>

a. in case of difference between systolic and diastolic categories check-up is recommended in shorter period  
 b. in case of blood pressure value different from anamnesis, other risk factor, organ damage the frequency of check-up can be modified  
 c. life-style changing is recommended

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## Blood pressure

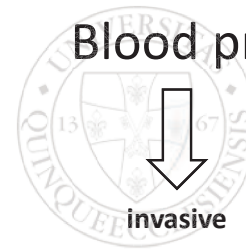
### hypotension:

- the systolic blood pressure does not exceed 100Hgmm
- orthostatic hypotension or postural hypotension



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## Blood pressure - measurement



- Extravascular pressure sensor
- Intravascular pressure sensor
- Swan-Ganz catheter
- PICCO



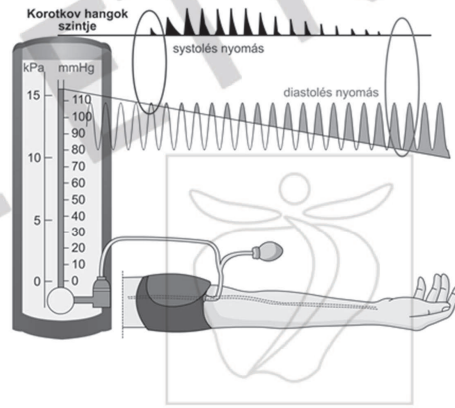
- mercurial blood pressure measuring technique
- aneroid method
- oscillometric method
- ABPM
- Ultrasound method
- Pulse wave velocity method (PWV)
- Blood vessel releasing method (Penaz or FINEPRES)
- Tonometric method
- Pulse pressure measurement
- Arterial stiffness
- Electronic method

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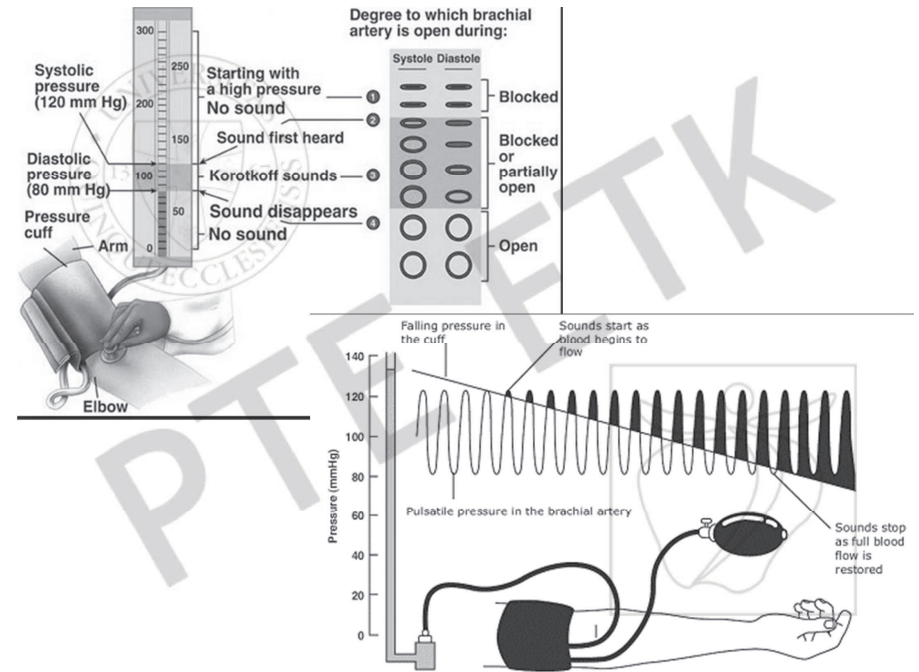
# Blood pressure

## Blood pressure measuring techniques

- auscultational method (Riva-Rocci, Korotkov)
  - Korotkov voices
    - Gallavardin auscultational gap
- palpational method
  - only the systolic value



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# Blood pressure

## Mercurial blood pressure measuring technique:

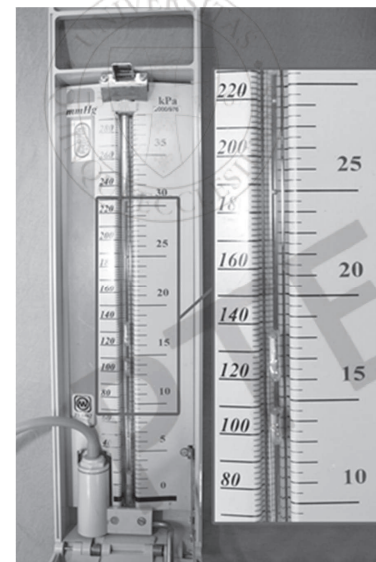
- „golden standard”
- closed system
- the pressure put on the mercury changes

## Aneroid blood pressure measuring technique:

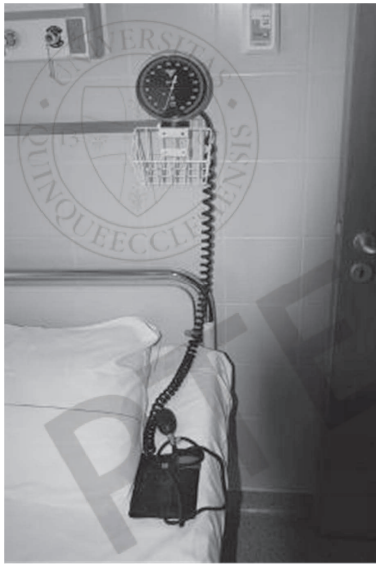
- The cuff a metal cylinder gets pressed together or expands



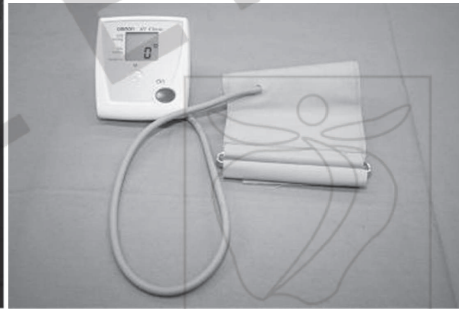
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aneroid device



oscillometric device

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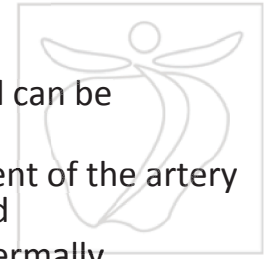
## Blood pressure

### Oscillometric method:

- the method is suitable for the direct measurement of arterial midpressure
- In what cases is it not suitable?
- ABPM, monitors, automatic and semi-automatic blood pressure devices

### Ultrasound technique:

- the movement of the artery wall can be perceived
- blood flow velocity and movement of the artery wall cause changes in ultrasound
- transmitter-receiver unit transdermally



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ABPM – ambulatory blood pressure monitor



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## Blood pressure

### Pulse wave velocity measuring technique (PWV):

- Pulse wave velocity varies with the arterial pressure
- Pulse wave velocity increases with decrease of cuff pressure
- In case of rise in blood pressure tension in the wall of blood vessels increases

### Blood vessel release technique (Penaz or Finapres method):

- Taking blood pressure on a finger
- Cuff releases artery
- Arterial volume change is detected by a transmission pletisemograph



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## Blood pressure

### Tonometric method:

- The power necessary for holding the pressed surface artery on bone is in proportion with arterial blood pressure
- The sensory head is usually put on the wrist
- Electropneumatic unit is necessary for pressing radial artery

### Electronic blood pressure technique:

- Inflate cuff automatically
- Built-in microphone is used for defining systole and diastole pressure
- Setting microphone above radial artery



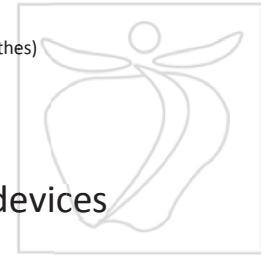
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## Blood pressure

### Groups of patients requiring special consideration in terms of blood pressure measurements are:

- **Children** (reliability, reproducible, IV. Korotkov sound, prefer sys.value, cuff size, oscillometric not)
- **Overweight patients** (cuff size, tight clothes)
- **Arrhythmia** (no oscillometric device)

### Qualification of blood pressure devices



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## Blood pressure - measurement

### Tasks before blood pressure measurement

- Suitable cuff size

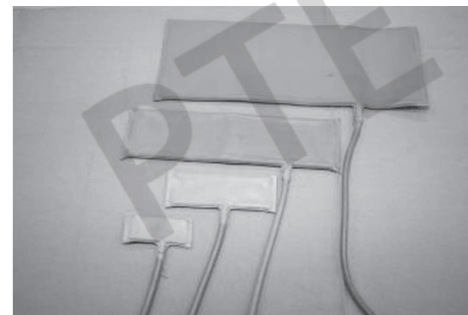
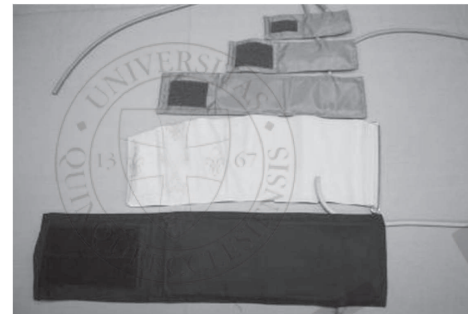
### Tasks during blood pressure measurement

- Arm position
- Body position
- Process of blood pressure measurement

### Tasks after blood pressure measurement



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**Before the measurement – 5 min. rest**



**palpate the systolic value**



**auscultational method**





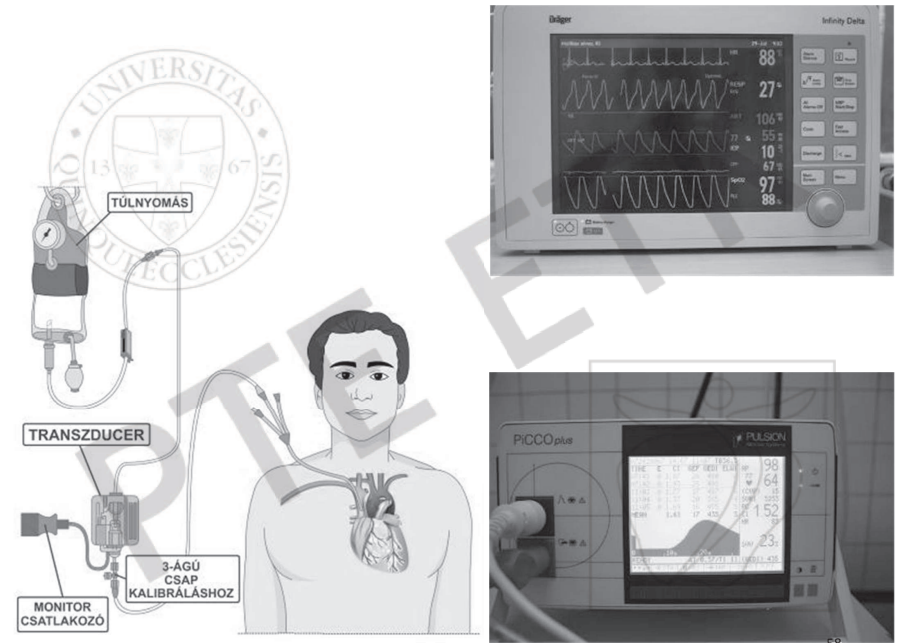
## Blood pressure

### Invasive techniques (into artery, vein)

- Extravascular pressure sensor
- Intravascular pressure sensor
- Swan-Ganz catheter
- PICCO



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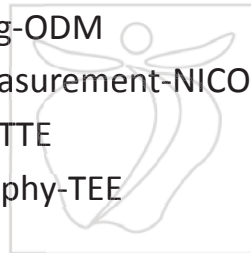


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## Blood pressure

### Less invasive and non-invasive haemodynamic monitors:

- Continuous monitoring of central venous oxygen saturation- CE-VOX
- Oesophageal Doppler Monitoring-ODM
- Non-Invasive Cardiac Output Measurement-NICO
- Transthoracic Echocardiography-TTE
- Transoesophageal Echocardiography-TEE



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## Vital Signs

body temperature breathing pulse blood pressure



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## Pulse

- by palpation
- by instrumental examination

Age	Pulse rate/min
Newborn	120-160
1-12 months	80-140
1-2 ys	80-130
3-6 ys	75-120
7-12 ys	75-110
13 ys- adult	60-100

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## Pulse

### Factors influencing the pulse rate are:

- Physical activity
- Age
- Gender
- Hormonal effects
- Temperature
- Emotional effects
- Medication
- Bleeding, loss of fluid
- Change in body position
- Pulmonary factors
- Cardiac factors
- Stress
- Stimulants: caffeine, smoking



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## How to count the pulse? – irregular?

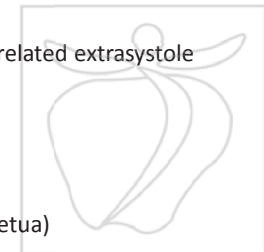


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## Pulse

### Assessing the quality of pulse:

- rhythm
  - regular
  - irregular
    - regular
      - bigeminy, trigeminy, quadrigeminy, related extrasystole
    - irregular
      - ES
      - respiratory arrhythmia
      - sinus arrhythmia
      - arrhythmia absoluta (arrhythmia perpetua)



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## Pulse

Frequency:

- Frequent (frequens) Rare (rarus)

Amplitude:

- High (altus) Low (parvus)

Suppressibility:

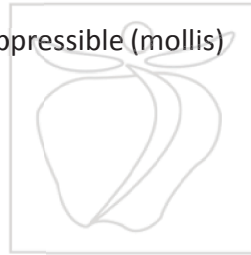
- Tight and full (durus) Soft and easily suppressible (mollis)

The pace of the expansion:

- Fast (celer) Slow (tardus)

Equality:

- Equal (equalis) Unequal (inequalis)



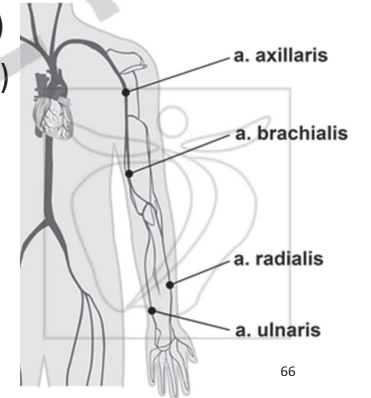
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## Pulse

The place measuring the pulse are:

- Upper limb:

- Axillary pulse (axillary artery)
- Brachial pulse (brachial artery)
- Radial pulse (radial artery)
- Ulnar pulse (ulnar artery)



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a. axillaris



a. brachialis



a. radialis

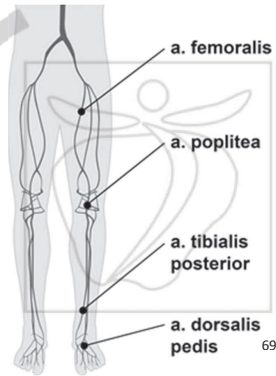


a. ulnaris

# Pulse

The place measuring the pulse are:

- Lower limb:
  - Femoral pulse (femoral artery)
  - Popliteal pulse (popliteal artery)
  - Posterior tibial pulse (posterior tibial artery)
  - Dorsal pulse (dorsal pedis artery)



a. femoralis

a. poplitea



a. tibialis posterior

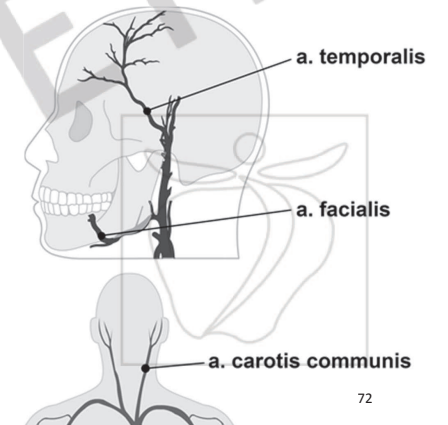
a. dorsalis pedis



# Pulse

The place measuring the pulse are:

- Head/neck:
  - Carotid pulse (carotid artery)
  - Facial pulse (facial artery)
  - Temporal pulse (temporal artery)
- Trunk:
  - Apical pulse (apex of the heart)

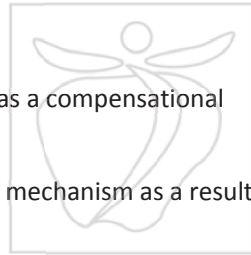


## Pulse

**We speak of tachycardia of an adult's patient pulse is over 100/min**

Its reasons can be:

- Hypovolemia related to a temporary compensational mechanism
- Raised body temperature
- Stress
- Heart disease, heart insufficiency, inflammation in the heart muscle
- Infection short physical activity
- The acute phase of pain
- Anxiety, excitement
- Positive chronotropic medication (atropin)
- Bleeding (the sympathetic activity increases as a compensational mechanism)
- Change of body position (sitting, standing)
- Pulmonary factors (part of a compensational mechanism as a result of bad oxygenization)
- Hyperthyroidism



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## Pulse

Treatment:

- In what cases should it be treated?
- The sooner the better (malignant arrhythmia, shortening dystole)
- Treating the underlying disease
- Increasing vagal tone
  - Valsalva maneuver
  - Carotis massage
  - Eyeball massage
- In an electric way (defibrillator)
- With medicaments



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## Pulse

**We speak of bradycardia in case an adult patient's pulse is less than 60/min**

It can be caused by:

- The parasympathetic nervous system being activated
- Cardiac insufficiency
- Medication
- The diseases of the conduction system of the heart
- Durable physical exertion
- Hypothermia
- Lying position
- Durable intensive pain
- Relaxation
- Negative chronotropic medication
- Poisons
- Increasing cerebral pression
- Hypoxia



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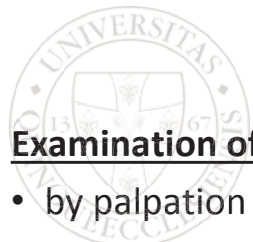
## Pulse

treatment:

- with medicaments
- instrumentally (pacemaker)
- manually (CPR)



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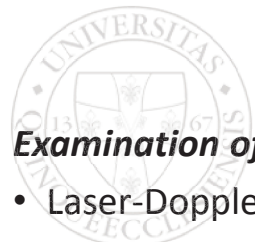
## Pulse

### Examination of the pulse:

- by palpation
- with auscultation
- defining pulse deficit
- pulseoximetry
- Doppler ultrasound



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## Pulse

### *Examination of the blood flow:*

- Laser-Doppler flow measurement
- Doppler index (DI)
- Measurements of heart rate
- Capillary refilling time



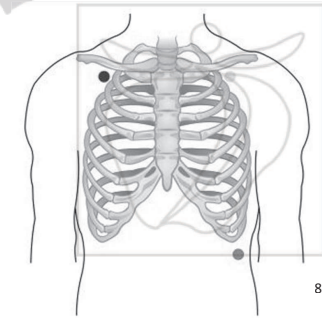
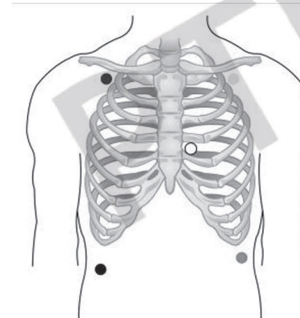
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## Pulse

### • Monitoring systems:

- Alarms
- Shuntings (three-and five -electrode systems)



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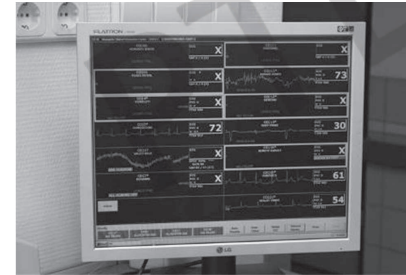
IEC – International Electrotechnical Commission (Hungary, Europe)  
 AAMI – Association for the Advancement of Medical Instrumentation (USA, Australia)

Color codes		Placement of the electrodes
AAMI	IEC	
White	Red	On the right side under the clavicle
Black	Yellow	On the left side under the clavicle
Red	Green	On the left side under the ribs at the anterior axillary line
Green	Black	On the right side lower part of the torso (should be placed anywhere on the body - grounding)
Brown	white	The place of the electrode depends on what chest lead needed to be monitored

## Pulse

Monitoring systems:

- Bedside monitors
- Central monitoring system
- Telemetry
- Modular monitor system



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## Pulse

important parameters measured by monitors:

- temperature (surface, core)



- blood pressure
- oxygen saturation
- ECG
- Protocol watch (watching sepsis)

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## Vital Signs

body temperature breathing pulse blood pressure



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## Breathing

- **Eupnoe:** regular, rythmic, calm and noiseless breathing with even depth and time span.
  - The proportion of inspiration-expiration is 2:3
  - The rate of respiration and pulse is 1:4

Physiological respiratory rate in different age groups

Age	respiratory rate/min
Newborn	35-40
Infants	30-50
Small children	25-32
Children	20-30
Adolescents	16-19
Adults	12-20

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## Breathing

- non-instrumental examination
  - rate, depth, sound, rhytm
- unawares counting – patient can affect his/her breathing
- just after the pulse counting



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## Breathing

- Abnormal respiratory sounds
  - Rale
  - Snore
  - Stridor
  - Gasp
- Hiccough
- Cough
- Sneeze

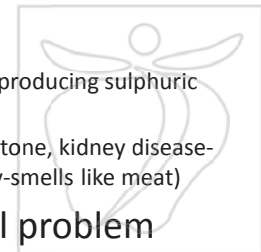


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## Breathing

### Bad breath-halitosis-foetor

- Real halitosis
  - Physiological
  - Pathological
    - Acute
    - Chronic
      - Oral ( caused by anaerobic bacteria producing sulphuric compounds)
      - Extraoral (DM-breath smells like acetone, kidney disease-smells like ammonia, liver deficiency-smells like meat)
- Pseudo halitosis- psychological problem



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