

Blood Pressure Monitoring

Blood pressure (BP) is the pressure that blood exerts on the walls of blood vessels. The source of pressure gradients is the **heart**, which maintains a constant circulation and unidirectional blood flow to ensure proper tissue perfusion even under different conditions (see local and general regulation).

Factors that Determine Blood Pressure

Factors that determine blood pressure can be:

- **Physical** = blood volume and vascular compliance;
- **Physiological** = cardiac output and peripheral resistance.

Pulse pressure is the difference between systolic and diastolic pressures. The average of the pressures during the cardiac cycle is called the **mean pressure** (MAP) according to the formula:

$$\text{MAP} = \frac{1}{3} \text{SP} + \frac{2}{3} \text{DP}$$

(SP = systolic pressure. DP = diastolic pressure. The mean arterial pressure is closer to the DP because diastole lasts longer).

Clinical Significance of Monitoring Blood Pressure

Blood pressure monitoring is essential for the assessment of **hypertension**, a disease of civilization with an increasing incidence. According to WHO, hypertension can be classified into **3 stages**:

- Stage I. – hypertension **without** organ changes;
- Stage II. – hypertension **with** anatomical, but **without** functional disorders (Left ventricular hypertrophy / angiopathia retinae...);
- Stage III. – hypertension **with** functional disorders (heart failure, LV dilatations, ischemic heart disease, myocardial infarction, renal insufficiency, encephalopathy).

Holter Monitoring of Blood Pressure

During outpatient monitoring of Holter-type blood pressure (ABPM Tonoport), blood pressure variability is continuously monitored during a specific period of time; most often around a 24-hour hemodynamic profile. The monitoring is fully automatic, non-invasive, and transmissible. The module records selected BP intervals oscillometrically (standardly every 15 minutes during the day and 30 minutes during sleep - can be freely changed). Then it stores S, D, SA, and PTK and heart rate values, which it programs into a graphical display of histograms.

As a general rule, blood pressure fluctuates during the day following a **circadian rhythm**. Physiologically, BP experiences a nocturnal decrease of about 10 mmHg both in normotensive and especially hypertensive patient.

Casual BP is a random one-time measurement of blood pressure, but it is by no means representative - it can even be misleading. The measured value can be affected by **physical activity, neurohumoral and physiological factors** (ie worries, stress, or subconscious fear)

Indications:

- Suspected episodes of hypertension or hypotension;
- Diagnosis of gestational hypertension;
- Identification of **paroxysmal hypertension** – exact localization within a time interval;
- Determination of severity (limit values, all-day hypertensive burden on the patient, dippers = day-night inversion / non-dippers = no nocturnal decline);
- Verification of the efficiency (pharmacodynamics) of antihypertensive therapy;
- Detection of **white coat hypertension** (individual with increased sympathetic activity in the presence of doctors) and thus prevention of unnecessary pharmacotherapy;
- Unclear collapse states.

Execution

- **Recording of parameters** = at the time of measurement (approx. 30 s), keep calm, especially around the arms.
- **Patient's diary** = records the time he woke up, got up, took medication, ate, drank coffee or alcohol, smoked, drove, worked, played sports, rested, went to sleep or woke up at night (sleep time identifies a decrease in BP and pulse, about 15 – S to 19 – D%).

Invasive Hemodynamic Monitoring

Invasive hemodynamic monitoring includes direct measurement of blood pressure, measurement of central venous pressure, possibly pulmonary artery pressure, cardiac output and monitoring of systemic and pulmonary vascular resistance.

Indication

- surgical procedures;
- massive blood loss;
- heart disease;
- circulatory shock states;
- renal failure.

Central Venous Pressure

Central Venous Pressure (CVP) is measured with a Swan-Ganz catheter inserted into the SVC. It is transcutaneously inserted local aesthetics through the v. Jugularis, v. Subclavia, v. Femoralis). The normal pressure = **0-8 mmHg** and corresponds to pressure changes in the right atrium (+EDV). It increases with **heart failure, hypervolemia**, or **tricuspid valve stenosis**.

Pulmonary Capillary Wedge Pressure

right|thumb|200px|Schématické znázornění polohy Swan-Ganzova katetru při měření tlaku v zaklínění

Pulmonary Wedge Pressure (PCWP) is measures using a Swan-Ganz catheter with a balloon at the end (inflates into 1.5 mL of air). It is inserted through the right heart into the lungs, then wedged in one of its branches where it is inflated. The sensed pressure in the lung is then an indirect indicator of left arterial pressure and preload. The standard is **8-12 mmHg**.

PWCP is increased in **left heart failure, pulmonary edema, mitral valve defects or cardiogenic shock**.

By gradually inserting the Swan-Ganz catheter into the lung, the pressure in SVC, VCS, PS and PK can be measured by pulmonary capillary pressure, which also corresponds to the pressure in the vessels behind the obliteration, ie in the pulmonary veins or the LS (vessels without valves)

For outpatient blood pressure monitoring, the following pressure are considered normal:

- average BP in waking state < **135/85 mmHg**;
- average BP during sleep period < **120/70 mmHg**;
- mean 24-hour bP < **130/80 mmHg**;
- blood pressure load < **15 %** of measured values

Links

Related Articles

- Blood Pressure
- Blood Pressure Measurement
- Arterial Catheter
- Home Blood Pressure Monitoring

References

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