Pulse oximetry/ principle

<pulse oximetry

Pulse oximetry is used for non-invasive measurement of blood oxygenation, more precisely the oxygen saturation of hemoglobin in arterial blood. It uses two basic principles:

- characteristic **absorption spectra** of two hemoglobin derivatives present in the blood in the highest concentration, i.e. oxyhemoglobin and deoxyhemoglobin,
- **fluctuations in the volume of** arterial blood in the tissue during the pulse wave.

Pulse oximeter

Pulse oximeters es that are attached to well-perfused areas - most often a patient's finger or earlobe. They have a built **-in light source** that passes through the tissue and hits a **detector** that measures its intensity.

The light source consists of two electroluminescent diodes (LEDs) emitting light at **660 nm** (red light) and **940 nm** (near infrared light). These are the wavelengths at which the spectra of oxyhemoglobin and deoxyhemoglobin differ the most. Around 660 nm , deoxyhemoglobin absorbs more significantly , while at 940 nm, oxyhemoglobin absorbs more . In addition, light of both wavelengths passes through tissues relatively well.

Measurement principle

The light that passes through the finger is absorbed by the skin, connective tissue, muscles, but also by arterial, venous and capillary blood. To **determine the oxygen saturation of hemoglobin in arterial blood** (sO_2), it is necessary to recognize how much light has been absorbed by the arterial blood itself and how much by all other absorbing tissues. It makes use of the fact that the volume of arterial blood in the arteries of the finger changes during the pulse wave and thus also the absorption of light conditioned by the hemoglobin in it. The other absorbance components are practically constant.

The pulse oximeter therefore measures the so-called **pulsating component of absorbance** (it makes up about 1-5% of the total absorbance). The difference between maximum and minimum absorbances during the pulse wave corresponds to light absorption by hemoglobin derivatives in the arteries. Since it is measured at two wavelengths, we obtain two differences ΔA_{660} and ΔA_{940} during the pulse wave . Their ratio corresponds to the ratio of the concentrations of oxyhemoglobin and deoxyhemoglobin, so it is possible to convert it to sO_2 .

in addition to sO_2 Commonly available pulse oximeters measure heart rate . In practice, they are therefore used as one of the basic tools for monitoring vital functions.

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