Monitoring in neurointensive care

Methods specific to neurointensive care can be broadly divided into **methods looking at global parameters and focal parameters** in the area of interest.

Global parameters include jugular oximetry, intracranial pressure monitoring and transcranial doppler ultrasonography.

Methods applied in **monitoring focal involvement** include microdialysis and intraparenchymal monitoring of partial tension of O_2 and CO_2, pH and temperature.

Measurement of intracranial pressure

Nowadays, **pressure sensors inserted directly into the tissues** are used to monitor intracranial pressure. For multimodal bedside monitoring, the currently used equipment is **oxygen and thermal sensors**, sensors determining the partial tension of CO_2 and pH, and microdialysis catheters.

Currently, **intraparenchymatous monitoring** of intraluminal pressure is most widely used. The pressure sensor is introduced from a projection over the nondominant hemisphere (1 cm anterior to the coronary suture) in the sagittal plane interleaved with the pupil of the corresponding side.

A unique technology at present is a multimodal sensor allowing **measurement of pHti, ptiCO2 and ptiO2**. The next letter after the subscript "ti" (tissue = tissue) indicates the type of tissue, e.g. Ptib (b = brain) is the partial pressure of oxygen in the brain, Ptim (m = muscle) in muscle, etc. Other modalities are also used - pH sensors, pCO_2 sensors, oxygen and temperature sensors.

Microdialysis

Microdialysis is not yet a standard method of brain monitoring, but its use in clinical practice may have a major impact on the quality of neurointensive care in the future. It is a method of **monitoring metabolic changes in the intercellular space**. A microdialysis catheter is inserted into the brain tissue. Ringer's solution flows through the system at a rate of 0.3 µl/min. The **micro-volumes** are then **analyzed in a liquid chromatograph**.

The standard metabolic profile includes: **lactate, pyruvate, glutamate, glucose and glycerol**.

In addition to the catheter inserted into the damaged area (the worse side), a **reference catheter** is inserted **into the undamaged tissue** (the better side) and a **catheter that should reflect systemic changes** (the best side). The latter is inserted into the subcutaneous adipose tissue in the abdominal region.

Use of spectroscopy near Infrared radiation (near infrared spectroscopy; NIRS)

The method is **based on the finding that light falling in the near-infrared region can penetrate skin and bone**.

The **absorption** of this **radiation by brain tissue depends on** the concentrations of haemoglobin, oxygenated and deoxygenated. These haemoglobins show different absorption of light. By analysing the changes in absorption it is possible to obtain information on the oxidative state of the brain tissue.

The clinical application of the method is based on the use of small optical sensors connected to a monitor. **Optical electrodes** are placed in the frontal region at a distance of 4-7 cm. The method is capable of analysing approximately 10 cm^3 of tissue. Its general **disadvantage** is the inability to differentiate between extracranial and intracranial flow changes.

Jugular Oximetry

Jugular oximetry **measures oxygen saturation in the jugular bulb** ($SjvO_2$), which is a reflection of global cerebral oxygenation or perfusion.

Transcranial doppler ultrasonography

TCD is used **to monitor blood flow velocity** in the basal arteries and carotid arteries. It is used to **diagnose vasospasm and regional perfusion** disturbances that may accompany brain trauma or subarachnoid hemorrhage.

Bispectral Index (BIS)

The bispectral index is a form of **EEG monitoring of depth of sedation and anesthesia**.

The result of software signal processing is a dimensionless number on a scale of 0 to 100, where **a value of 100 corresponds to full consciousness**, 80-65 to sedation, 65-40 to moderate to deep anaesthesia, and values < **40** represent **coma**. **Optimal values for surgical procedures are 40-60.**

The index has **very high validity** as documented by studies in adult patients during inhalational anaesthesia. The use of the method in paediatric anaesthesia and in intensive care beds is still under investigation.

A limitation of the method in children is the large variability of values for adequate analgosedation (a particular value in one patient may indicate a good level of analgosedation, while the same value in another patient may not). Nevertheless, there are a number of studies in pediatric patients that demonstrate the benefit in improving titration of sedation and the objectivity (quantification) of the assessment of depth of sedation.

Relationship between BIS value and state of consciousness in the review

Value of BIS	State of consciousness
100	full consciousness
80–65	sedation
65–40	medium to deep anaesthesia
< 40	coma

Links

Related Articles

- Cardiopulmonary monitoring
- Renal monitoring
- Multifrequency bioelectrical impedance

Source

HAVRÁNEK, Jiří: *Ostatní monitoring.*