

Electrophysiological methods in clinical diagnosis

Introduction

The methods used in the clinical diagnosis of CNS disorders can be divided into *two groups*:

1. Subjective

- for example, tests, rulers for measuring pain, etc. The disadvantage of the method is the possibility of simulation or dissimulation and the fact that it cannot be applied to patients who are unwilling or unable to cooperate.

1. Objective

- **EEG (electroencephalography)**
- **Evoked potentials**
- **Unit neuronal activity**

EEG

Electroencephalography is a *non-invasive method for recording brain activity*. The electrical potentials of neurons are measured using external electrodes. We then describe several types of waves on the electroencephalogram - we evaluate **the frequency and amplitude of the waves**. In general, as the frequency increases, the amplitude of the waves decreases. The EEG also changes with age - from childhood the frequency of the waves gradually increases, in adulthood the α activity stabilizes, but this can be reduced by factors such as *hypoglycemia or a decrease in temperature*.

Activity types

- **α activity** – $f = 8-13$ Hz, in people who are not focused, in complete rest with closed eyes (so-called relaxed wakefulness)
- **β activity** – $f = 14-30$ Hz with low amplitude, physiologically α activity changes to β activity in persons with emotional or sensory stimulation, this phenomenon is called **desynchronization**. The change also takes place when the eyes are opened - the so-called **α block**.
- **δ activity** – $f = 0.5-3.5$ Hz, physiologically only in deep sleep
- **θ activity** – $f = 4-8$ Hz, physiologically in small children, in adults only during sleep
- **γ activity** – $f = 30-60$ Hz

Electroencephalography is mainly used today to *diagnose epilepsy* ((on spike wave recording) and **sleep disorders**. Another use includes **the diagnosis of brain death**, which is defined on the EEG by an isoelectric line lasting at least 20 minutes and the inability to elicit an evoked potential.

Evoked potentials

Certain nuclei and areas of the brain. can be stimulated using electrodes placed at different places on the head. An EPSP (excitatory postsynaptic potential) then occurs in the areas stimulated in this way. The device then measures **the latency time between the stimulation and the response** (vznik potenciálu). (evoked potential). The method of evoked potentials is used in the diagnosis of sensory disorders in patients who cannot, do not want or are unable to cooperate with other examination methods (e.g. patients in a coma, mentally retarded, children...). We recognize several types of examination:

- **ERA (evoked response audiometry)** – activation of the auditory pathway and auditory nuclei, physiological latency *50-350 ms*.
- **VER (visual evoked responses)** – light stimulation, for the diagnosis of disorders of the visual pathway, latency *50-350 ms*.
- **SER (somatosensory evoked responses)** – stimulation of peripheral nerves, latency *50-350 ms*.
- **BEAR (brain-stem evoked auditory responses)** – gradual response of all parts of the auditory pathway, latency up to 10 ms. This method is used to diagnose hearing problems and **multiple sclerosis**.

Unit neuronal activity

This method makes it possible to measure **the activity of individual neurons**. The activity is sensed either intracellularly - with glass or metal microelectrodes, or extracellularly. It is used more experimentally, as it is expensive and demanding. Thanks to the sensing of unit activity, it was found that even in specific nuclei there are cells responding to a different than the primary modality of the nucleus (cells responding to light, etc. were discovered in the cells of the auditory nuclei).

Links

Related articles

- EEG
- Epilepsy
- Evoked potentials
- Sleep

References

- GANONG, William F. *Review of Medical Physiology*. 1st edition edition. H & H, 1995. pp. 681. ISBN 80-85787-36-9.
- ROKYTA, Richard. *Physiology for bachelor's studies in medicine, science and physical education*. 1st edition edition. ISV, 2000. pp. 359. ISBN 80-85866-45-5.