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Реакція серцево-судинної системи на дію холоду в осіб з різним рівнем артеріального тиску

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Response of Cardiovascular System to the Effect of Cold in Individuals With Different Levels of Blood Pressure

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The level of blood pressure (BP) is a key indicator for assessing the functional state of the cardiovascular system and the body as a whole (Kearney, 2005). Cold stress is an exogenous factor that in the vast majority of people leads to the activation of the sympathetic nervous system (Kim, 2018).

The examination included 240 practically healthy individuals (men and women) aged 18–22. All the examined subjects had their initial blood pressure measured on the right arm, and a rheographic index (RI) examination using the "Reocom" computer set. Based on the initial BP level, the subjects were divided into three groups according to the recommendations of the European Society of Cardiology (Ramzy, 2018): Group I of individuals with an optimal or normal-low baseline blood pressure level (<120/80 mm Hg), Group II – persons with a normal blood pressure level (120/80–129/84 mm Hg), group III – persons with a normal-high blood pressure level (130/85–139/89 mm Hg). The cold pressor test (CPT) was performed according to a standardized protocol: the left hand of the subjects, who were in a room with an air temperature of 19 ± 2 ºC, was immersed in an ice-cold (4 ± 2ºC) container of water up to the level of the wrist for 1 minute. After that, blood pressure was measured on the right arm at 0, 2 and 4 minutes.

In all groups, a significant ($p < 0.05$) increase in systolic blood pressure was found after CPT compared to the initial level. The difference between baseline systolic blood pressure before and after CPT among individuals with normal-low blood pressure was (22.3 ± 2.37) mm Hg, among persons with normal blood pressure – (22.8 ± 2.10) mm Hg, and among persons with normal-high blood pressure – (23.5 ± 2.32) mm Hg. A significant effect of resting blood pressure on the increase in systolic blood pressure after CPT was established. Conducted rheographic studies revealed that RI significantly decreased in the 3rd minute after CPT in all groups of subjects. In groups I and II, RI recovered to baseline values at the 7th minute after CPT, and in group III it remained significantly lower than the baseline level. The RI in subjects of group III was significantly lower than subjects of group I at the 3rd and 7th minutes after CPT. The mathematical analysis of the heart rhythm showed that the LF (Low frequency) component and the LF/HF ratio were significantly higher after CPT, compared to the initial value in group III. Based on the conducted research, the following conclusions can be drawn:

1. A significantly greater increase in systolic BP in response to CPT was found in subjects with a normal-high baseline BP.

2. In people with initial blood pressure >130/70 mm Hg, a more significant influence of the sympathetic nervous system on the central and peripheral links of the cardiovascular system was observed in response to cold stress.

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Застосування холоду для діагностики функціонального стану вестибулярного аналізатора

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Application of Cold to Diagnose the Functional State of Vestibular Analyzer

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The vestibular system provides sensory, static, and dynamic information, thereby ensuring body balance (Aghababaei Ziarati M, 2020). It is known from the scientific literature that the excitability of the sensory cells of the vestibular analyzer is thermodynamically sensitive (Rabbitt RD, 2016). Therefore, understanding the deep mechanisms of vestibular receptor sensitivity is important not only for understanding the basis of temperature sensitivity disorders but also for the development and use of thermal stimuli for fundamental biophysical research and therapeutic hypothermic interventions.

In modern vestibulology, standard thermal stimulation of the external auditory canal with 250 ml of water for 30 seconds is widely used to diagnose the functional state of the vestibular analyzer. The water temperature is 30°C for cold irrigation and 44°C for warm irrigation (Gufoni M, 2023).

Aim: to determine the effect of cold stimulation on the vestibular analyzer using a calorimetric test.

During the work, scientific studies on the use of calorimetric cold tests in the diagnosis of the functional state of the vestibular analyzer were analyzed.

According to the meta-analysis, the calorimetric test proved to be one of the most useful research methods for determining the labyrinth response. It is also one of the few methods that allows one labyrinth to be evaluated independently of another. It is worth noting that ice water irrigation can be considered if there is no response to either warm or cold stimulation, as this test method has been shown to have higher sensitivity and specificity than warm water (Murphy KA, 2023).

In summary, we can say that the cold-caloric test is more informative in the diagnosis of vestibular disorders than the thermal one.