Probl Cryobiol Cryomed 2022; 32(4):301
https://doi.org/10.15407/cryo32.04.301

Діелектричні характеристики еритроцитів хворих на ішемічний та геморагічний інсульт в умовах лікувальної дії гіпотермії

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Dielectric Characteristics of Erythrocytes of Patients With Ischemic and Hemorrhagic Stroke During Therapeutic Hypothermia

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Therapeutic hypothermia is widely used in the treatment of various mechanisms of brain damage, including decreased metabolic activity, release of glutamate, inflammation, production of reactive oxygen species, release of mitochondrial cytochrome and others [Yenari, 2012]. Because therapeutic hypothermia affects many aspects of brain pathophysiology, it can be considered as a model of neuroprotection and used to identify potential therapeutic goals [Morozova, 2019]. Although this therapy has shown great prospects, at the cellular level there are still problems that limit the possibility of routine treatment for each pathological condition. Given that the adaptation mechanisms and their violations in the body are accompanied by biochemical and biophysical changes, this may be assumed to affect the dielectric properties of the object under study, namely blood cells.

The aim of the work is to study the effect of therapeutic hypothermia (0–15ºC) and alteplase (thrombolytic agents of indirect mode of action) on erythrocyte state in 34 patients with ischemic and hemorrhagic stroke by dielectric Fourier spectroscopy. The experiment used blood samples from patients collected within 24 hours from the onset of symptoms and before administering any drug. Alteplase was added to the erythrocyte suspension and incubated for 5 min at 0 to 15ºC. A short pulse of current (10^{-5} s) was passed through the suspension samples, followed by registration of the polarization decay function of the sample, and then a Fourier transform of this function was performed. The dielectric characteristics of samples of erythrocyte suspensions of donors and different groups, with added alteplase, were described using three 'Cole-parameters' (r0, x0, y0) [Cole, 1968]. The significance of differences between samples was assessed by the non-parametric Mann-Whitney test.

The results indicate a statistically significant difference between the groups r0 and x0 for erythrocyte suspensions in patients with hemorrhagic and ischemic stroke within the temperature range from 5 to 10°C under conditions of adding alteplase at a concentration of 0.0012 mg (0.25–0.5 mg/kg dose *in vivo*) to 5.0 ml of cell suspension. An increase in r0, x0, y0 in the erythrocyte suspension in patients with ischemic stroke was obtained in comparison with the erythrocyte suspension in patients with hemorrhagic stroke. This effect disappears at a temperature of 14°C and above, which corresponds to the data on an increased rate of ion transmembrane transport in cell membranes, which varies by about 15°C [Gimsa, 1994]. The inhibitory effect of thrombolytic agents of the indirect mode of action disappears when the concentration of alteplase increases to 0.0015 mg, which leads to the alignment of all measurement points within the temperature range from 5 to 10°C, and may be associated with increased cation exchange at low temperatures.

Probl Cryobiol Cryomed 2022; 32(4):301
https://doi.org/10.15407/cryo32.04.301a

Внесок кріобіології в покращення якості консервування біологічних об'єктів у біобанку

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Learning From Cryobiology to Improve Biopreservation Quality in a Biobank

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Biobanks are important infrastructures that play an essential role in biomedical research. The main goal of a biobank is to create and maintain an extensive biorepository of valuable biological samples that will be used for subsequent research purposes. A clear understanding of the principles of cryobiology and translation of scientific knowledge into biobank and biorepository storage practices will facilitate the quality of stored biospecimens and improve biobanking processes.

Key elements of the biobank's activities include the collection, processing, validation, conservation, management and distribution of viable (cells and bacteria) and non-viable (nucleic acids, serum, plasma, solid tissues and proteins) biospecimens. The scientific value of such biospecimens depends on a range of pre-analytical, analytical, and post-analytical parameters to which the samples are subjected during their biobank processing life cycle.

The presentation is intended to highlight the fundamentals and tools of biobank sample processing, including the management of critical pre-analytical variations that can introduce significant bias into the molecular profiles of stored biospecimens. Evidence-based quality control (QC) measures are required for different sample types at different storage temperatures to ensure sample stability under certain low temperature conditions. Some examples will be given of how knowledge of the principles of cryobiology can facilitate the development and validation of standard operating procedures (SOPs) for biobanks. A discussion of various factors affecting the stability of biospecimens during short and long term storage, as well as some practical applications in the routine workflows of biobanks, will be discussed.