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ANTIHEMOLITIC ACTIVITY OF AMPHIPHILIC COMPOUNDS UNDER CONDITIONS OF POSTHYPERTONIC SHOCK OF HUMAN RED BLOOD CELLS

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Long-term storage of red blood cells (RBC) is currently a valuable approach for the donors with rare blood groups and combatants. Accumulation of the cryopreserved RBC can be useful in emergency or clinical situations, where the demand exceeds the supply (Henkelman S. et al., 2010). At the stage of thawing and removal of penetrating cryoprotectants, the cells are damaged as a result of the changes in medium temperature and osmolarity. In this research a posthypertonic shock was used as a model to investigate the effects of cryodamage factors on cells. Some amphiphilic compounds are known to prevent a cell damage under stress factors conditions (Semionova E.A. et al., 2017).

The aim of this work was to study the efficiency of amphiphilic compounds belonging to different classes on sensitivity of human red blood cells to the posthypertonic shock action.

Posthypertonic shock (PHS) of RBC carried out by transferring the cells from the dehydration medium (1.65 mol/L NaCl) into rehydration one (0.15 mol/L NaCl) at 0 and 37°C. Amphiphilic compounds were added to the rehydration medium before the transfer of RBC. The level of RBC hemolysis was determined spectrophotometrically at a 543 nm wavelength. Amphiphilic compounds, which belong to different classes of surfactants, were used in this work. Anionic surfactants are represented by sodium decyl sulfate (C10), cationic with chlorpromazine (CPR), nonionic with decyl β, D-glucopyranoside (DGP). The antihemolytic activity of amphiphilic compounds was expressed as a percentage reduction of hemolysis in the presence of compounds in relation to hemolysis an amphiphile-free sample.

The level of posthypertonic lysis of RBC was 70 ± 5%. At 0°C all amphiphilic compounds were found to significantly reduce the hemolytic damage of cells. So the use of C10 and DGP led to a 3-time decrease in the level of human RBC hemolysis, and the supplement of CPR in 4 times. At 37°C, the protective effect of amphiphilic compounds under PHS action was not revealed. Effective concentrations, with which there was observed a minimal lysis of cells, for C10 and CPR, are close and make 400 and 600 μmol/L, respectively. Effective concentration for DGP is equal to 1,000 μmol/L. The antihemolytic activity of anionic C10 and nonionic DGP was 66 ± 5 and 65 ± 5%, respectively, and cationic CPR was slightly higher, i.e. 77 ± 3%.

Thus, amphiphilic compounds belonging to different classes demonstrated a high antihemolytic activity under PHS. The mechanism of posthypertonic lysis of human RBC is based on the processes associated with the formation of microdefects in plasma membrane at dehydration stage and their growth at rehydration stage. Apparently, amphiphilic compounds, incorporating into plasma membrane, prevent the evolution of microdefects up to the hemolytic pore size.

Henkelman S. et al. Transfusion. 2010, 50(11): 2393-2401.
Semionova E.A. et al. Probl Cryobiol Cryomed 2017; 27(1): 51–60