

Euro Surgery 2018: New effective method for preservation of red blood cells by means of nanotechnology- Andrey Belousov, Kharkov Medical Academy of Postgraduate Education

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Abstract:

This study was devoted to the learning of the use of nanotechnology to correct the functional activity of red blood cells (RBCs) at the storage stages at a positive temperature. It was established that saline NaCl, which had previously been processed by magnetite nanoparticles (ICNB) had a marked membrane-stabilizing effect, inhibits haemolysis and increasing the sedimentation stability of preserved RBCs. The complex analysis of the obtained data allowed to determine the primary mechanisms effect of the saline NaCl, which had previously been processed by ICNB on the preserved RBCs. The proposed method of additive modernization of preserved RBCs was adapted to the production process. The optimisation results were obtained in creating a simple and practical method of additive modernization of preservation solutions that does not violate the compliance requirements, improves the quality, efficiency and safety transfusion of RBCs.

Introduction:

For quite a while, RBCs parts have been set up as concentrates. The concentrates of RBCs are suspended in supplement added substance arrangement. These jam and broadens the timeframe of realistic usability of their, permitting up to 6-7 weeks of refrigerated stockpiling. In during stockpiling RBCs experience dynamic collection of physicochemical changes. At now, clinical examinations have recognized that RBCs transfusion is hazard factor for expanded morbidities and mortalities in specific gatherings of patients. To address these issues, there is reestablished enthusiasm for discovering approaches to moderate the unfriendly impacts of blood stockpiling. This will improve the quality, productivity and wellbeing of RBC parts. By and by, more slow advancement is being made in discovering approaches to hinder the negative impacts of the RBCs stockpiling injury.

In spite of the RBCs having been a most loved test model for cell scientists and organic chemists, RBCs stockpiling research has more than once exhibited that a great deal of essential science about RBCs is as yet not surely knew. The intricacy of the between connection between RBCs natural chemistry, cytoskeletal structure and film properties have made it hard to foresee how RBCs will react to various capacity conditions. Presentation of RBCs to non-physiological capacity conditions has highlighted the presence of already obscure biochemical components in RBCs, including apoptotic-like procedures, particle and osmotic channels that act uniquely in contrast to expected, introduction of new or modified receptors perhaps

because of oxidative or potentially protease/glycosidase exercises or adjusted senescence.

It was discovered that magnetite nanoparticles directed the action of the compound connection of the cancer prevention agent framework in red platelets, successfully tweak metabolic procedures in leukocytes in solid and debilitated patients. Already the intricate examinations were shown that in entire normalized biocompatibility of magnetite nanoparticles have vague and regulated impact on metabolic procedures. Investigation of ultrastructure of the reticuloendothelial framework (lungs, liver and kidneys) it was demonstrated that after infusion of biocompatibility magnetite nanoparticles caused vague actuation of the metabolic procedures, increment capability of organelle cells and versatile systems, increasing speed of reparative procedures a degree of macromolecules and films. Sorption and attractive properties of magnetite nanoparticles not just permit specifically ingest the protein of surface film cells by (as indicated by the standard of magnetophoresis) yet in addition to forestall the oxidative adjustment of proteins by method of balancing out the dynamic gatherings, normalizing a condition of receptors that are situated on a superficial level layer of cells, expanding movement of catalysts' film bound.

In a trial it is appeared on rodents, that biocompatible normalized nanoparticles of ICNB can be viably utilized at MRI. On the system of activity, the nanoparticles of ICNB cause the convertible changes which is explanation behind the fleeting increment of versatility of protons of hydrogen in close to cell fluid. It unavoidably adjusts the metabolic procedure in dangerous cells that in context has trust in explaining better approaches for the objective treatment of harmful neoplasm. The consequences of these investigates have not just extended the comprehension of the components of impact of magnetite nanoparticles on condition outside and intracellular spaces yet in addition have opened new parts of the cell digestion, decided the film job of cell compounds in the guideline procedures of digestion.

Materials and Methods:

Materials

1. Normalized intracorporeal nanobiocorrector of ICNB was taken as magnetite nanoparticles. Magnetite nanoparticles incorporated by co-precipitation technique. The primary material science and compound properties of ICNB the accompanying information were introduced:

- Concentration of the colloidal arrangement of magnetite nanoparticles in physiology arrangement of NaCl is 0.0225%.
- Theoretical osmolality of colloid arrangement is 500 mosmol/l
- Size of magnetite nanoparticles is 6-12 nm;
- Total territory of surface magnetite of nanoparticles $S_s = 800-1200 \text{ m}^2/\text{g}$;
- Magnetization of immersion $I_s = 2.15 \text{ ka/m}$;
- ζ - potential = - 19

2. 9% NaCl arrangement.

3. 9% NaCl arrangement which recently was prepared by ICNB in proportion 4:1.

Objects of research

- Red platelets (RBCs) into sacks containing anticoagulant citrate, supplement phosphate and dextrose (CPD);
- Red platelets (RBCs) into sacks containing anticoagulant citrate, supplement phosphate, dextrose and adenine (CPDA-1).

Of each pack of 3 ml measures of red platelets was circulated into 20 sterile glass tubes. At that point, into the initial 10 containers of control were included of 2 ml sums 0.9% NaCl arrangement. Into the following 10 containers of test were included of 2 ml sums 0.9% NaCl arrangement, which recently was handled by ICNB.

Results and Discussion:

IR retention spectra at the underlying phase of the investigation of RBCs suspensions in the control and test in ranges 400-1300 cm^{-1} and 1200-4000 cm^{-1} .

Investigation of changes happening in the IR spectra of tests of control and test in the CPD medium was demonstrated that during the initial 28 days of capacity.

Nonetheless, there are a few contrasts in their force because of the qualities of the blood contributor from which the example was gotten. Following a three-week stockpiling of RBCs (stage IV) in the range there were no recognizable changes that would show unsettling influence of the sub-atomic structure of the erythrocyte layer.

Conclusion:

The strategy for infrared spectroscopy made it conceivable to follow the elements of changes in terrifically significant kinds of securities in atoms of erythrocyte films at the phases of their stockpiling at positive temperature. The outcomes obviously demonstrated that the introduced technique for utilization of

nanotechnology fundamentally expands the capacity time of RBCs in various forms of additives because of instruments to lessen infringement of the sub-atomic structure of proteins and lipids in the erythrocyte films. Later on, with utilized nanotechnologies is intended to keep on considering the highlights of metabolic procedures of saved RBCs at capacity stages at positive temperature.

By and by, today clearly the introduced strategy for utilization of nanotechnology isn't just safe for use practically speaking in the Blood Service, Transfusiology and Hematology, yet additionally is the most encouraging advancement venture.