Influence of polymeric nanoparticles solution on the structure and mechanical properties of RBCs estimated by AFM method

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Influence nanoparticles on structure and mechanical properties of red blood cells (RBCs) membranes in patients with type 2 diabetes mellitus by AFM method have been studied. Nanoparticles of Poly(acrylic acid) (PAA)with linear polyacrylic chains (average molecular weights M_n= 6000, 20000, 57000, 225000 Da)in physiological solution (c = 0.2 and 1 mg/ml) were used to effect on RBCs suspension.They are incubated at room temperature during 20, 40 and 60 minutes. After that suspension of RBCs were washed nanoparticles and fixed with glutaraldehyde on the plates of mica. Structure and mechanical properties of RBCs membranes were estimated with using standard silicon cantilevers (Mikromash, K= 3 N/m, R= 30 nm). Elastic modulus was calculated by Hertz model, adhesion force – by Jonson-Kendall-Robertz.Change of properties of RBCs membranes were analyzed according to two groups of patients: men and women.

It has been received, that significant changes in the structure of RBCs membranes were not occurred. However, after 60 minutes of incubation traces of PAA nanoparticles were found.Mechanical properties were not changed after influence PAA at c=0.2 mg/ml with M_n=6000 Da to RMCs membranes of men, but significant changes (about 50 %) were established for women. Influence of PAA with M_n =20000 Da reduced at 30% for women, while M_n = 57 000 was increased to 60 %elastic modulus for two groups of patients. Also, 50% changes of elastic modulus characterized after influence nanoparticles with M_n = 225 000Da.

Physiological solution causes no changes mechanical properties of RBCs membranes. After influence PAA with M_n = 57 000Da, concentration 1 mg/ml on RBCs membranes changes of mechanical properties consist ofabout 25%, for other $M_n$changes are not find. This is due to the inactive state of the particles in solution with a concentration 1 mg/ml.