Modification of Rigidity of Surface Areas, Size and Shape of Liposomes by Potassium Phenosan.

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Phenosan potassium salt (PPS, potassium salt of β-4-hydroxy-3,5-di-tret-butylphenyl-propionic acid) is a phenolic synthetic antioxidant; PPS is effective in very low concentrations on various models in vivo and in vitro. However, the mechanism of its action is still unknown. Early we have shown that PPS induced the changes in order parameter S of plasma membranes (PM). We hypothesized that the main target of action of PPS are membrane lipids. To check this suggestion we investigated the effect of PPS in a wide range of concentrations (10^{-4}-10^{-21} M) on physical properties of liposomes, have been prepared from lipids extracted from PM. The structural changes in lipids were studied with ESR-spectrometer (Bruker-200D) by spin probe technique using stable nitroxyl radical 5-doxylstearic acid (C5) to examine the rigidity modulation of the surface liposome regions ($8A^{o}$). The obtained dose dependence has the same polymodal character, as in the case of PM, where 2 maxima are observed in definite intervals of PPS doses 10^{-6}-10^{-7} M and 10^{-14}-10^{-15} M, separated between each other by so_called «dead zone» in which the effect does not manifest itself. Moreover, we detected an appearance of additional thermoinduced structural transition in lipids treated by 10^{-14}-10^{-15} M of PPS occurring at the temperature 22-26^{o}C. PPS-induced the shape modification of liposomes was studied using atomic force microscopy (AFM) (Solver P47).The “extention” of liposome images was observed under the PPS effect in concentration 10^{-6}-10^{-7} M and 10^{-14}-10^{-15} M in comparison with control, but there were no some changes while PPS was used in concentration 10^{-8}-10^{-10} M («dead zone»). These pictures were confirmed by determination the liposome sizes: PPS in concentration 10^{-6}-10^{-7} M and 10^{-14}-10^{-15} M resulted in increasing the ratio of length to width of liposomes (effect near 15%) calculated by AFM images and dynamical light scattering method (Zetasizer Nano S, Malvern) which has demonstrated the 15% increase in the mean diameter of liposomes after addition of PPS in suspension at concentrations 10^{-6}-10^{-7} M and 10^{-14}-10^{-15} M too. PPS modification of the structure of surface areas of liposomes strongly correlates (r=0,98, p=0,001) with changes liposome diameter and shape.Thus, the results of our experiments allow us to conclude that lipids are the primary target of PPS effect on plasma cell membranes.