Cell and Tissue Biology 2016 vol.10 N3, pages 217-226

Structural characterization of platelets and platelet microvesicles

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Abstract

© 2016, Pleiades Publishing, Ltd.Platelets are blood cells without nuclei, which, in conjunction with fibrin, cause bleeding to stop (hemostasis). Cellular microvesicles are microscopic particles released into extracellular space under activation and/or apoptosis of cells of different types. Platelet microvesicles form the main population of blood circulating through microvesicles and play an important role in the reactions of hemostasis, thrombosis, and many other (patho)physiological processes. Despite the large number of studies that have been devoted to the function of platelet microvesicles, the mechanisms of their formation and structural details remain poorly understood. The ultrastructure of the initial platelets and microvesicles formed in vitro from resting cells and platelets activated by arachidonic acid, ADP, thrombin, and calcium ionophore A23187 is investigated in this study. The intracellular origin, stages of formation, structural diversity, and size of microvesicles were analyzed according to the results of transmission electron microscopy of human platelets and isolated microvesicles. It was shown that thrombin, unlike other activators, not only stimulates microvesiculation of the plasma membrane, but also causes decomposition of cells with the formation of subcellular particles that have sizes comparable with the size of the microvesicles from the outer membrane of the cells. Some of these microparticles are cellular organelles surrounded by a thin membrane. The size of isolated microvesicles ranges from 30 to 500 nm, but their size distribution depends on the nature of the activating stimulus. The obtained results contain new data on the formation of platelet microvesicles and their structural diversity, which are important for understanding of their multiple functions in health and disease.

http://dx.doi.org/10.1134/S1990519X1603010X

Keywords

cell ultrastructure, electron microscopy, microvesicles, platelet activation, platelets