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Ultrastructural Characterization of Lipid Droplets of Rat Hepatocytes after Whole Body 60-Cobalt Gamma Radiation

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Abstract : Lipid droplets (LDs) are normally presented in greater or lesser number in the cytoplasm of almost all eukaryotic and some prokaryotic cells. They are independent organelles composed of a lipid ester core and a surface phospholipid monolayer. As a lipid storage form, they provide an available source of energy for the cell. Recently it was demonstrated that they play an important role in other many cellular processes. Among the many unresolved questions about them, it is not even known how LDs is formed, how lipids are recruited to LDs and how they interact with the other organelles. Excess fat in the organism is pathological and often associated with the development of some genetic, hormonal or behavioral diseases. The formation and accumulation of lipid droplets in the cytoplasm can be increased by exogenous physical or chemical agents. It is well known that ionizing radiation affects lipid metabolism resulting in increased lipogenesis in cells, but the details of this process are unknown. To better understand the mode of formation of LDs in liver cells, we investigate their ultrastructural morphology after irradiation. For that, Wistar rats were exposed to whole body gamma radiation from 60-cobalt at various single doses. Samples of the livers were processed for analysis under a conventional transmission electron microscope. We found that when compared to controls, morphological changes in liver cells were evident at the higher doses of radiation used. It was detected a great number of lipid droplets of different sizes and homogeneous content and some of them merged each other. In some cells, it was observed diffused LDs, not limited by a monolayer of phospholipids. This finding suggests that the phospholipid monolayer of the LDs was disrupted by ionizing radiation exposure that promotes lipid peroxydation of endo membranes. Thus the absence of the phospholipid monolayer may prevent the realization of some cellular activities as follow: - lipid exocytosis which requires the merging of LDs membrane with the plasma membrane; - the interaction of LDs with other membrane-bound organelles such as the endoplasmic reticulum (ER), the golgi and mitochondria and; - lipolysis of lipid esters contained in the LDs which requires the presence of enzymes located in membrane-bound organelles as ER. All these impediments can contribute to lipid accumulation in the cytoplasm and the development of diseases such as liver steatosis, cirrhosis and cancer.

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