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Novel aspects of application of cadmium telluride quantum dots nanostructures in radiation oncology

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Background of the study: In the last two decades, quantum dots nanomaterial have garnered a great deal of scientific interest because of their unique properties. Quantum dots (QDs) are inorganic fluorescent nanocrystals in the size range between 1 and 20 nm. Due to their structural properties, they possess distinctive properties and behave in different way than crystals in macro scale, in many branches of human life. It was already showed that the negatively charged CdTe QDs (−21.63±0.91 mV), with good dispersity and fluorescence stability, were rapidly internalized via endocytosis by HUVECs. Methodology: Cadmium telluride quantum dots (CdTe QDs) were labeled by 68Ga radio nuclide for fast in vivo targeting and Coincidence imaging of tumors. Using instant thin layer chromatography method, the physicochemical properties of the Cadmium telluride quantum dots labeled by 68Ga NPs (68Ga@ CdTe QDs) were found high enough stable in organic phases, e.g. a human serum, to be reliably used in bioapplications. In vivo biodistribution of the 68Ga@ CdTe QDs nanoconposite was investigated in rats bearing fibro sarcoma tumor after various post injection periods of time. Results: The 68Ga NPs nanocomposite exhibited a rapid as well as high tumor uptake in a very short period of time (less than 10 min), resulted in an efficient tumor targeting/imaging. Meantime, the low lipophilicity of the 68Ga NPs caused to its fast excretion throughout the body by kidneys (as also confirmed by the urinary tract). Conclusion: Because of the short half-life of 68Ga radionuclide, the 68Ga@ CdTe QDs with an excellent tumor targeting/imaging and fast washing out from the body can be suggested as one of the most effective and promising nanomaterials in nanotechnology-based cancer diagnosis and therapy.

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