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The role of nanocarrier on biofate of anticancer drugs

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Background and Aims: An overview is presented of a potent approach for treating cancer that uses nanoparticles to deliver anticancer drugs. Since these drugs are neither specific nor targeted to the cancer cells, improved delivery of them appears to be a reasonable challenge.
Methods: 9-nitrocamptothecin (9-NC) loaded Poly lactic-glycolic acid (PLGA), PLGA-PEG with different ratio of PEG (0–15%) and folate coated PLGA nanoparticles were formulated by nanoprecipitation method and optimized the amount of polymers, emulsifier and internal and external phases by statistical artificial neuronal network. The nanoparticles was characterized that could efficiently encapsulate hydrophobic drug, and also have suitable release behavior. Macrophage uptake efficiency and in vitro cytotoxicity of the formulated nanoparticles was also evaluated in different cancer cell lines (MCF7, AGS, Hela, PC-3, JC744A.1, and HT-29). To comparatively investigate the pharmacokinetics of different nanoparticle formulations, a simple HPLC analysis method was developed for the quantification of 9-NC (lactone and total forms) in plasma of rats after intravenous administration.
Results: PLGA-PEG nanoparticles showed dramatic prolongation in blood circulation, as well as reduced macrophage uptake, compared to free drug and PLGA nanoparticles. Superior anti-proliferative effect and cell cycle inhibition was observed in case of PLGA-folate nanoparticles over loaded nanoparticles and native 9-NC. In pharmacokinetic studies, the area under the plasma concentration-time curve of PLGA-PEG and PLGA-folate was increased significantly ($P < 0.01$) in comparison with the values for the 9-NC-PLGA nanoparticles and solution. The MRT value of PLGA- PEG nanoparticles in plasma was greater than 3-5 times more than other formulations which means could be invisible for reticuloendothelial macrophage systems.
Conclusions: The present results suggest that, a combinational coating of PEG and folate may represent a significant step in the development of long-circulating and more cytotoxic target drug delivery carriers and could change the biofate of this valuable drugs.

Keywords: 9-Nitrocamptothecin; Nanoparticles; PLGA-PEG; PLGA-folate; Cytotoxicity; Macrophage uptake; Pharmacokinetic study