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Investigating the toxicity of a stimuli-sensitive PEGylated nanoniosomal doxorubicin on acute myeloid leukemia cell line

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Statement of the Problem: Drug delivery is one of the best methods to overcome the drug side effects and to improve the drug efficiency (1-3). Nanotechnology have attracted much attention in drug delivery due to its exceptional characteristics and features (4-7). One of the effective strategies for targeted chemotherapy of cancer is the use of lipid nanocarriers.

Methodology and Theoretical Orientation: In this experimental study, an optimal formulation of niosomal drug containing doxorubicin was developed to monitor the potency against cancer cells. To do this, niosomal vesicles were prepared using phosphatidylcholine (20%), span60 (52.5%), cholesterol (22.5%), and DSPE-PEG2000 (5%) by the thin-film method. Doxorubicin was loaded into the niosomes using an inactive loading method.

Findings: The features and characteristics of the nanocarrier were evaluated using Zeta-Sizer, SEM, FTIR, drug release, cellular uptake, and the cytotoxicity of the nanodrug carrier system by the MTT method. Niosomal vesicles-containing doxorubicin showed a size of ~156.8 nm, drug encapsulation efficiency of ~94.18%, zeta potential of ~-3.52 mV, and polydispersity index (PDI) of ~0.265. The prepared niosomes indicated a drug-controlled release system and FTIR analysis showed no interaction between nanocarriers containing drug and doxorubicin. Moreover, morphological examination of nanocarriers using SEM microscopy revealed that they had spherical structures. Also, cellular studies showed that drug toxicity was higher in encapsulated form of the drug compared with non-encapsulated doxorubicin which was confirmed by the cellular uptake results.

Conclusion & Significance: We successfully developed a novel DOX-loaded PEGylated nanoniosomes possessed nanoscale size, proper zeta potential, high encapsulation efficiency, and sustained drug release. Nanoniosomes were coated with polyethylene glycol (PEG) (8), in order to increase the stability (9, 10), half-life in systemic circulation (11), permeability (12), and retention effect (13), as well as decreasing the immunogenicity (14, 15). The results confirmed the proper physicochemical characteristics of these nanocarriers that significantly increased the toxicity of the encapsulated drug against the KG-1 cell line. It seems niosomal nanocarriers can be considered suitable carriers for drug delivery to cancer cells.

Biography

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