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RESEARCH ARTICLE

Improvement the Efficacy of Cisplatin by Niosome Nanoparticles Against Human Breast Cancer Cell Line BT-20 : an *In Vitro* Study

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Abstract

Today, cancer is one the most important challenges in modern medicine. Meanwhile, breast cancer is one of the most common causes of mortality among cancers. The initial response to the treatment and then becoming resistant to the cisplatin is one of basal challenges of treatment of breast cancer. Recently, using nanotechnology including drug nanocarrier named niosome can decrease adverse effects and increase the efficiency of treatment. The aim of this research is using niosome nanoparticles containing cisplatin and investigation of their lethal effect on breast cancer cell line. The research found that by using of niosome nanoparticles can be provided a suitable formulation of cisplatin drug. Therefore, the results show the efficiency of nanoniosome cisplatin is more than free drug. This decreases used dose and therefore the damage of other tissues.

Keywrds: Nanoniosome- cisplatin- breast cancer.

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Introduction

Cancer starts when cell mutates in the growth controlling genes. In the natural modes, if cell Mutates irreparably, it will kill himself but if it can't kill himself, these cells and/or their progeny and lineage may divide uncontrollably with wrong genetic information [1]. Recently, nanotechnology allows targeted treatment to reduce adverse effects of drug and increase of efficiency. Nano - scale drug carriers are used for passing of biological barriers and drug release. Niosome is one of these carriers [2]. Niosomes are non - ionic surfactant vesicles that their vesicle system can be used as carriers of lipophilic and amphiphilic. Theirs non - ionic property leads to less toxicity and theirs limited reaction with cell that increase therapeutic index of encapsulated drug [3].

Material and Methods

Materials

Span60, cholesterol, Polyethylene glycol 3350, cisplatin, human breast cancer cell line BT-20 .

Preparation of nanoparticles containing drug

At first span 60, cholesterol and polyethylene glycol 6,000 were mixed in diethyl ether. The solvent was evaporated using rotary evaporator in 90 rpm and 45 °C. The thin film formed at the bottom of round bottom flask was then hydrated by PBS containing cisplatin (1 mg/ml) and stirred. The final concentration were calculated 7, 4, 1 and 3.3 mM respectively. To provide smaller and more homogenized particles, they were sonicated using bath sonication for 10 min. blank nanoparticles were prepared with the abovementioned method without the drug.

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Morphological evaluation of nanoparticles

Size, shape, and probable crystallization of constructed niosomal nanoparticles were evaluated using light microscopy.

MTT test

MTT test was used to investigate cytotoxicity of the formulation containing cisplatin and compared its effect than standard drug.

Statistical analysis

Obtained data were analyzed by SPSS software version 16. In addition, all stages of toxicity were analyzed by Pharm software.

Results

Morphological evaluation

Light microscopy showed the niosomal nanoparticles as hollow spherical to ellipsoid configuration that dispersed in the matrix (Figure 1).

Cytotoxicity

The results of the cytotoxicity tests of nano-cisplatin and free drug are summarized in Table 1. Control nanoparticles were devoid of toxicity, even at high concentrations. IC50 is reported in micromolar. Results show that nano-conjugated cisplatin is more cytotoxic than cisplatin. In other words, nano-conjugated cisplatin's IC50 is less than cisplatin.

Discussion

Nanotechnology is being carried out in the treatment of different diseases through nanoparticulate drug delivery system, because it supplies several benefits over conventional drug delivery system [4]. This study reported that the niosomal formulation could be one of the promising delivery systems for the breast cancer treatment by using drug silymarin.Reverse phase evaporation technique is a suitable method for preparation of cisplatin loaded niosomal nanoparticles wich was confirmed by appropriate properties of nanoparticles. PEG was applied in this investigation by reason of proper stability in blood circulation, low immunogenicity, water solubility and antigenisity and also the ability of extend the period of drug release [5]. Drug release is a strongly influence factor in drug delivery systems [6]. In this research, a sustained release of cisplatin from nanoparticles was here perceived.

in conclusions, The cytotoxicity effects of the nanodrug in comparison with free cisplatin illustrated the higher efficiency of nanoniosomal cisplatin in destruction breast cancer cells. This fact may be in order to the nanoniosomal drug has a amphipathic structure like the bilayer structure of a breast cell line membrane and can easily penetrate to tumour and release the nanomedicine directly into the target cell, therefor causing the death of BT-20 cell line.

Table 1. IC_{50} Cytotoxicity of Nano-Conjugated Cisplatin, Free Cisplatin, and Control Group At front Side Category Of Cell Cancer the Breast *In Vitro* Human

BT-20 (Control Drug) IC_{50} (µM)	BT-20 (Free Drug) IC_{50} (µM)	BT-20 (Nano Drug) IC_{50} (µM)
164.1±16.0	135 ±8.8	92±4.7

IC50 (in terms of µM) shows the average result from three experiments.

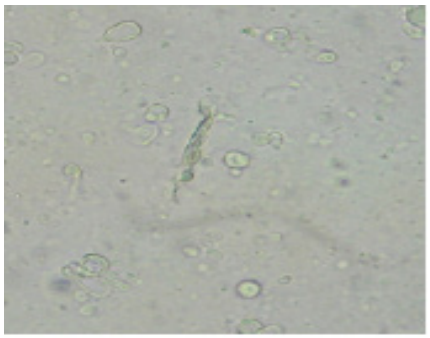

Figure 1. Light Microscopy of Cisplatin Loaded Pegylated Niosomal Nanoparticles

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