Comparative Study of Using Different Types of Nanoparticles with Laser and Electric Field Irradiation for Ehrlich Tumor Treatment

Thesis

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ABSTRACT

In this dissertation, a study of hyperthermia for cancer treatment through the use of magnetic nanoparticles is presented. Hyperthermia has been in use for many years, as a potential alternative method in cancer treatment, Direct electric current and laser has been used successfully to raise the tumor temperature to around 42°C in superficial tumors without causing damage to surrounding healthy tissues. Magnetic fluid hyperthermia involves the use of magnetic nanoparticles injected into the tumor before exposure to Direct electric current and low-level laser therapy. The magnetic energy in the nanoparticles is converted into heat allowing for a more rapid rise of temperature in the tumor to the desired level. In addition, the nanoparticles allow the heat absorption to be focused on the tumor and can be used to treat deep tumors in organs, such as the liver and kidney Iron oxide magnetic nanoparticles were considered for this study as they are non-toxic and bio-compatible.

Many ways investigated for cancer treatment, including surgery, chemotherapy, and radiotherapy. In our study new method was performed as photodynamic laser therapies with nanoparticles (NPs), Methotrexate drug (MTX), direct electric current (DEC), and combinations of them which give an interesting combined therapeutic effect. The Primary Purpose of this work was to investigate the ability of NPs to transform laser energy and DEC into therapeutic heating. In the present work, a total of 56 male mice weighing 20-35 gm of 4-5 weeks age will be used in all the experiments. A suspension of 10^6 cells/ mL isolated from Ehrlich ascites carcinoma in mice will be prepared. The animals will be injected into the right flank with 0.25 mL of this suspension. When tumors reach approximately 4-10 mm in diameter, mice will be randomly divided into groups, each of 7 mice. Characterization of prepares NPs, tumor weight, volume, and histopathology investigated. The results showed that the tumor capsule infiltrates by inflammatory cells. Mice treated with NPs and MTX shows a similar degree of infiltration areas of necrosis and newly formed blood capillaries are also noticeably. Mice treated with NPs, MTX, and low-level laser therapy (LLLT) shows increased tumor cell necrosis with aggregates and sheets of invasive malignant cells. Mice treated with NPs, MTX, and DEC shows slightly increased tumor cell necrosis and increased mononuclear inflammatory cells. Mice treated with NPs, MTX, LLLT, and DEC shows massive tumor cell necrosis with only minimal

aggregates of malignant cells. It concluded that treat tumor with LLLT, DEC, MXT, and NPs give us the most inhibition for it.

This study also contains an explanation of the practical results of the research and its interpretation, which showed that there is a highly significant decrease in the normalized tumor size with the different treatment modalities as compared with the animal bearing tumor (control group) as a result of thermal treatment and injection of nanoparticles and showed the absence of any side effects on the blood measurements of nanoparticles.