Research in Pharmaceutical Sciences, 2012;7(5)
School of Pharmacy and Pharmaceutical Sciences
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Gene expression studies of MCF-7 cell line treated with mitoxantrone-coated magnetic nanoparticles

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Background and Aims: Magnetic nanoparticles (MNPs) are novel synthetic structures for target therapy of cancer. These particles which contain magnetic elements can be retouch by magnetic field and because of having free folic acids can bind to up-regulated folic acid receptors. The aim of this study was investigation of bioimpacts of mitoxantrone (MXT) and mitoxantrone-coated magnetic nanoparticles (M-MNPs) on Michigan Cancer Foundation - 7 (MCF-7) cell lines.
Methods: For this the cultivated cells were exposed to different doses of the MXT and M-MNPs and the bioimpacts were assessed. DNA fragmentation was detect by running total extracted DNAs from treated cells on Agarose gel and for measuring membrane alterations and confirming early and late apoptosis, FITC-labeled annexin V assay and DAPI staining assay were done. In the next step, gene expression of AKt, Caspase 9 and BAX was analyzed by quantitative real time polymerase chain reaction (qRT-PCR).
Results: DNA ladder assay showed a significant digestion in the DNAs of treated cells despite treated with MNPs. Annexin V assay confirmed early and late apoptosis and results showed significant changes in the treated cell membranes with M-MNP, in which less than Mitoxanrone. Treated cell staining with DAPI illustrated a punctual shrinkage in the nucleus of cells. Quantitative real time PCR show activation of tumor suppressor genes (BAX & Caspase 9) and a significant down-regulation in AKt as a tumor inducer gene that means apoptosis pathways were activated. Discussion: The results indicate that these mitoxantrone-coated nanoparticles have the same bioimpacts of MXT and activate apoptosis pathway by the mitochondrial pathway, however lower than this chemotherapy agent.

Keywords: MCF-7; Mitoxantrone; Magnetic nanoparticles (MNPs); Quantitative real time polymerase chain reaction (qRT-PCR)