Evaluation of Cytotoxic Effect of Mitoxantrone Conjugated Magnetite Nanoparticles and Graphene Oxide-Magnetite Nanocomposites on Mesenchymal Stem Cells

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Abstract : In this work targeted drug delivery is proposed to decrease adverse effect of drugs with concomitant reduces in consumption and treatment outgoings. Nanoparticles (NPs) can be prepared from a variety of materials such as lipid, biodegradable polymer that prevent the drugs cytotoxicity in healthy cells, etc. One of the most important drugs used in chemotherapy is mitoxantrone (MTX) which prevents cell proliferation by inhibition of topoisomerase II and DNA repair; however, it is not selective and has some serious side effects. In this study, mentioned aim is achieved by using several nanocarriers like magnetite (Fe3O4) and their composites with magnetic graphene oxide (Fe3O4@GO). Also, cytotoxic potential of Fe3O4, Fe3O4-MTX, and Fe3O4@GO-MTX nanocomposite were evaluated on mesenchymal stem cells (MSCs). In this study, we reported the synthesis of monodisperse Fe3O4 NPs and Fe3O4@GO nanocomposite and their structures were investigated by using field emission scanning electron microscope (FESEM), Fourier transform infrared (FTIR) spectra, atomic force microscopy (AFM), Brauneur Emmet Teller (BET) isotherm and contact angle studies. Moreover, we used 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay to evaluate cytotoxic effects of MTX, Fe3O4 NPs, Fe3O4-MTX and Fe3O4@GO-MTX nanocomposite on MSCs. The in-vitro MTT results indicated that all concentrations of MTX and Fe3O4@GO-MTX nanocomposites showed cytotoxic effects while all concentrations of Fe3O4 NPs and Fe3O4-MTX NPs did not show any cytotoxic effect on stem cells. The results from this study indicated that using Fe3O4 NPs as anticancer drug delivery systems could be a trustworthy method for cancer treatment. But for reaching excellent and accurate results, further investigation is necessary.

Keywords : mitoxantrone, magnetite, magnetic graphene oxide, MTT assay, mesenchymal stem cells
Conference Title : ICBCN 2017 : International Conference on Biomaterials, Colloids and Nanomedicine
Conference Location : Amsterdam, Netherlands
Conference Dates : August 07-08, 2017