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Abstract

Radiofrequency hyperthermia by encapsulated Fe3O4 nanoparticles induces cancer cell death via time-dependent caspase-3 activation

Anjali Chauhan, Sushil K. Jha and Bijoy Kumar Kuanr
Special Centre for Nanoscience, Jawaharlal Nehru University, India

Abstract:

It is known that radiofrequency induced magnetic hyperthermia (MHT) mediated by magnetic nanoparticles result in cancer cell death[1]. MHT triggers apoptotic cell death under mild temperature range, resulting in targeted cell death with limited side effects. In contrast, necrosis occurs at elevated temperature conditions that leads to inflammation and extensive damage to the surrounding healthy cells, and hence inappropriate for clinical settings[2,3]. Therefore, it is necessary to explore the optimum temperature for inducing death in cancerous cells, in turn will affect the mode of cell death. This study was investigated the optimum MHT conditions that trigger maximum death to the cancer cells, and their possible mode of mechanism. For in-vitro MHT, Fe3O4 were synthesized using electrochemical method and surface modified using chitosan polymer (Fig. a). Chitosan encapsulated Fe3O4 exhibited good colloidal stability, low cytotoxicity and high specific absorption rate. MHT at 43°C for 45 min was found to be optimum temperature for the robust occurrence of cancer cell death (85%), as validated by MTT assay (Fig. c). Cell death pathway investigated on A549 cells using western blot, flow cytometry and fluorescence microscopy (Fig. d) suggested that during initial stages of recovery, apoptosis was main mode of cell death. While at later stages, major apoptosis and minor necrosis were observed. Hence, this study suggests that it is important to find out the long-term effect of hyperthermia treatment on cancer cells and their consequences on surrounding healthy cells. In Vivo studies are currently ongoing in xenograft rat models to elucidate the same mechanism under physiological conditions.

Biography:

Anjali Chauhan has completed her M.Sc. in Biotechnology from South Asian University, India. Currently, she is pursuing Ph.D. from School of Life Sciences, Jawaharlal Nehru University, India. Her area of research is 'synthesis and characterization of magnetic nanoparticles and their effect on neuronal survival and cognitive functions. In addition, synthesis of new magnetic nanoparticles for the treatment of cancer using magnetic hyperthermia therapy. She has published 3 papers in reputed journals and 1 book chapter in Springer publication.

Recent Publications:

1. Chauhan A, et al;Proc Natl Acad Sci U S A,2020
2. Chauhan A, et al;Virusdisease,2018
3. Chauhan A, et al; J Neuroinflammation,2018
4. Chauhan A, et al;Front Immunol,2018
5. Chauhan A, et al;Clin Sci (Lond)2017
6. Chauhan A, et al;Aging (Albany NY),2016

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