Analyzing the CD44-Targeting Capabilities of Chitosan-Coated Iron Oxide Nanoparticles in Glioblastoma Multiforme

Commander, Thomas (School: Episcopal School of Jacksonville)

Glioblastoma Multiforme (GBM) is a type of malignant brain tumor and it is the most lethal with a median survival of only 21 months. It is characterized by an extremely strong recurrence rate (100%) which is caused by resistance to conventional therapies. Cancer Stem Cells (CSCs) are a subpopulation of cancerous cells that are highly proliferative and drive tumor metastasis, recurrence, and therapeutic resistance. CSCs can be identified by certain stemness markers such as CD44 which are distinguishable via flow cytometry. This study examines the efficacy with which chitosan (CS)-coated solid core iron oxide nanoparticles (NPs) target CD44 in highly malignant GBM cells, thus providing valuable insight into a viable option for the direct and specific treatment of the most dangerous form of GBM cell. CS-coated iron oxide nanoparticles were synthesized using a co-precipitation method and characterized via dynamic light scattering to show optimal characteristics for neurological applications. GBM cells were treated with various dosages of nanoparticles and analyzed for cytotoxicity and uptake. The collected zeta potential of the synthesized NPs was a very positive +39.8 mV which is advantageous for use in neuro-oncological applications because of their ability to effectively and safely traverse the blood-brain barrier. By observing NP uptake and cytotoxicity, I was able to collect significant results relating to the use of chitosan-coated NPs for the treatment of GBM via effective targeting of CD44. By comparing NP uptake in CD44-blocked cells and non-blocked cells both treated with CS-coated iron oxide NPs, data was gathered that showed the viability of the CD44 targeting mechanism in CS-coated iron oxide NPs because of the greater NP clustering in unblocked GBM6 cells.

Awards Won:
Fourth Award of $500