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Citation (Brief summary) on the research work

Iron oxide nanoparticles as a novel magnetically guided targeted therapy for breast cancer treatment

Cancer is considered as a significant cause of death worldwide. Triple-Negative Breast Cancer (TNBC) is a type of breast cancer that is aggressive and prone to rapid multiplication at the lymph nodes and has a higher chance of recurrence. As the three prominent women's hormonal receptors (Progesterone, Estrogen and Human epidermal growth factor) are not present in TNBC, hormone therapy or immunotherapy are excluded from the list of treatments for TNBC. Hence chemotherapy using taxanes, anthracyclins, PARP inhibitors, etc. remains the major treatment against TNBC. Unfortunately, inherited cytotoxic activity, non-targeted delivery, and higher doses of these chemotherapeutic drugs result in severe systemic side effects and poor prognosis and the destruction of a large number of healthy cells compared to the TNBC cells. Therefore, it is the high time to implement advanced and novel strategies like nanotechnology in the treatment and control of TNBC. Among various nanoparticles, Iron oxide nanoparticles (IONPs) is considered as the most efficient in cancer diagnosis and treatment due to some specific physical and chemical properties. IONPs has so many unique features like superparamagnetism, good tissular diffusion, and better bioavailability with low toxicity.

The main objective of this present proposal is to develop IONPs to be applicable for breast cancer treatment and reduce the side effects of chemotherapeutic drugs. As per our first protocol, the IONPs was prepared using green synthesis method from Triphala churna extract (TIONPs) to evaluate its anticancer efficacy in treating TNBC. Iron oxide nanoparticles have been synthesized from an aqueous extract of Triphala churna for the first time at a low cost and lesser time in a single-step process with enhanced antioxidant and cytotoxic activity. This synthesis did not utilize any harsh synthetic chemicals for the reduction of iron ions, instead it was carried out by green method using the reactive phytochemical groups of Triphala churna extract. The TIONPs showed promising cytotoxic activity against TNBC cells and associated skin cancer cell (A431), in comparison to the normal human cells. These TIONPs can be

rapidly localized directly into the target organ utilizing their inherent paramagnetic property to reduce the side effects of current chemotherapeutic drugs. The green synthesized TIONPs can come up as a future anticancer drug for TNBC treatment.

In the next approach IONPs with superparamagnetic property will be prepared to evaluate the targeted drug delivery of doxorubicin at the breast cancer site using external magnet. Our developed superparamagnetic IONPs will attempt to minimize the treatment limitations through external magnetic field guided accumulation of drug selectively at the targeted breast cancer cell site and thereby reducing its administered daily dose for improved safety and efficacy. Additionally, the biodistribution and toxicity assessment will be done to confirm the reduction in risk of accumulation of drug at any other site of body and its associated toxicity. After the establishment of successful pre-clinical and clinical trials, our developed superparamagnetic IONPs can be sold as a parenteral product for the external magnet therapy of breast cancer. This kind of medicine should be launched as quickly as possible to help many people overcome this difficulty, as breast cancer is a serious concern now across the globe. Although the marketability of this sort of product (superparamagnetic IONPs) is enormous, no product for the treatment of breast cancer has yet been commercialised.

Citation on the research work

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