J Integr Oncol 2018, Volume 7
DOI: 10.4172/2329-6771-C1-003

3rd World Conference on
BREAST AND CERVICAL CANCER
September 24-25, 2018 Abu Dhabi, UAE

Utilizing autophagic potential of nanoparticles for sensitizing breast cancer cells to chemotherapy

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Cancer is one of the most important leading causes of death worldwide and among cancer types. Breast cancer is the most frequent malignancy among women. Currently, chemotherapy is the main therapeutic strategy for treatment of breast cancer patients. However, occurrence of drug resistance and other side effects highlights an unmet need to develop new potent therapeutic strategies. Nanoparticles (NPs) attracted a great deal of interest as new therapeutic tools for treatment of cancer, mostly due to their unique properties such as fine-tuning capability and cell fate modulatory potentials. Notably, autophagic potential of these ultra-fine particles has been recently proposed as a novel therapeutic strategy for cancer. Autophagy is an intracellular degradation system that occurs in response to a variety of stressful conditions with the aim of sustaining cell survival or inducing cell death at high level of stress. In context of cancer, autophagy plays tumor suppressor or tumor promoter functions, depending on stage of the disease. Here, we show that aggregates of Titanium Dioxide (TiO2) NPs at low concentrations (<100 μg/ml) have potent autophagic activities in different breast cancer cell lines. Pretreatment of breast cancer MCF-7 cells with TiO2 NPs synergistically increases cytotoxic effects of doxorubicin and 5-fluorouracil drugs. The effect of TiO2 NPs in sensitizing MCF-7 cells to pharmacological doses of both anti-cancer drugs (doxorubicin and 5-fluorouracil) is mediated through boosting of autophagy in the cells. Therefore, we provide evidence that autophagic potential of NPs can improve current chemotherapeutic strategies in breast cancer cells in a new approach that we term as the NP-based autophagy boosting therapy.

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