Combining Radiotherapy and Immunotherapy using nanoparticle loaded immunogenic biomaterials for cancer treatment

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Abstract

Cancer today is the main cause of death worldwide and metastasis accounts for over 90% of all cancer associated suffering and death, and arguably presents the most formidable challenge in cancer management. The main techniques involved in the cancer treatment are the Radiotherapy (RT), chemotherapy and Immunotherapy. Although these methods and especially RT have made significant advances in the last decades, there is still a significant amount of cancer patients experiencing toxicities on normal cells, cancer reappearance and deadly metastasis. A new method using nanoparticle-aided radiotherapy (RT) where high Z nanoparticles can amplify damage to cancer cells during radiotherapy, generating neoantigens that can serve as a cancer vaccine powering cytotoxic immune system T-cells to kill both local and metastatic cancer is presented. The combination of RT with the Immunotherapy can further boost local and metastatic tumor cell kill, with minimal damage to healthy tissue. Biodegradable polymers are used as payload for targeted, concentrated and controlled delivery of nanoparticles and immunotherapeutics into the tumor volume, over time. The multifunctional properties of metallic nanoparticles (MNP) related to their physic-chemical properties and biocompatibility make them very suitable for applications both in diagnosis an therapeutic treatment, a field known as theranostics.